Special Issue in Computational Biological Data science

Computational Bio Science is at the cusp of big innovations in order to guarantee highly affordable, advanced and smarter healthcare facilities for people across the globe. With data science and analytics fields are gaining a lot of mind and market shares, there are brighter days ahead for bioscience, the seamless and spontaneous combination of biology and computational techniques. Further on, clouds are being positioned as the best-in-class IT infrastructures for doing all kinds biological experiments, searching, processing, ingestion, storage and visualization. This special issue is formulated with the aim of bringing forth a variety of right and related research contributions to empower future biologists and physicians to bioinformatics tools and analysis methods. All kinds of technological advancements, newer tools, techniques and tips, the best practices, the key metrics, and healthcare processes.

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Biologically Inspired Intelligent Robots Using Artificial Muscles

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Abstract:
Artificial Intelligence is a branch of Science which deals with helping machines finds solutions to complex problems in a more human-like fashion. This generally involves borrowing characteristics from human intelligence, and applying them as algorithms in a computer friendly way. A more or less flexible or efficient approach can be taken depending on the requirements established, which influences how artificial the intelligent behavior appears. Humans throughout history have always sought to mimic the appearance, mobility, functionality, intelligent operation, and thinking process of biological creatures. This field of biologically inspired technology, having the moniker biometrics, has evolved from making static copies of human and animals in the form of statues to the emergence of robots that operate with realistic appearance and behavior. This paper covers the current state-of-the-art and challenges to making biometric robots using artificial muscles.
Keywords: EAP, Artificial Muscles, Artificial Intelligence, Biometrics

1. Introduction

AI is generally associated with *Computer Science*, but it has many important links with other fields such as *Math's*, *Psychology*, *Cognition*, *Biology* and *Philosophy*, among many others. Our ability to combine knowledge from all these fields will ultimately benefit our progress in the quest of creating an intelligent artificial being.

2. Artificial Intelligence

Computers are fundamentally well suited to performing mechanical computations, using fixed programmed rules. This allows artificial machines to perform simple, monotonous tasks efficiently and reliably, which humans are ill-suited to. For more complex problems, things get more difficult... Unlike humans, computers have trouble understanding specific situations, and adapting to new situations. Artificial Intelligence aims to improve machine behavior in tackling such complex tasks.

2.1.When will Computers become truly intelligent?

Limitations...To date, all the traits of human intelligence have not been captured and applied together to spawn an intelligent artificial creature. Currently, Artificial Intelligence rather seems to focus on lucrative domain specific applications, which do not necessarily require the full extent of AI capabilities. Researchers know this limit of machine intelligence as narrow intelligence. There is little doubt among the community that artificial machines will be capable of intelligent thought in the near future. It's just a question of what and when. The machines may be pure silicon, quantum computers or hybrid combinations of manufactured components and neural tissue. As for the date, expect great things to happen within this century!

2.2. How does AI work?

Technology.....There are many different approaches to Artificial Intelligence, none of which are either completely right or wrong. Some are obviously more suited than others in some cases, but any working alternative can be defended. Over the years, trends have emerged based on the state of mind of influential researchers, funding opportunities as well as available computer hardware.Over the past five decades; AI research has mostly been focusing on solving specific problems. Numerous solutions have been devised and improved to do so efficiently and reliably. This explains why the field of Artificial Intelligence is split into many branches, ranging from Pattern Recognition to Artificial Life, including Evolutionary Computation and Planning.

3. Artificial life through robotics:

3.1. Laws of Robotics:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.[1]
2. A robot must obey the orders given it by human beings except where such orders would conflict with the first law.
3. A robot must protect its own existence as long as such protection does not conflict with the first or second law.

Robotics has been an evolution of the field of automation where there was a desire to emulate biologically inspired characteristics of manipulation and mobility. In recent years, significant advances have been made in robotics, artificial intelligence and other fields, allowing to make sophisticate biologically inspired robots [Bar-Cohen and Brea zeal]. Using these advances, scientists and engineers are increasingly reverse engineering many animals' performance characteristics. Biologically inspired robotics are a subset of the interdisciplinary field of biometrics. Technological progress resulted in machines that can recognize facial expressions, understand speech, and perform mobility very similar to living creatures including walking, hopping, and swimming. Further, advances in polymer sciences led to the emergence of artificial muscles using Electro active Polymer (EAP) materials that show functional characteristics remarkably similar to biological muscles. Making creatures that behave like the biological model is a standard procedure for the animatronics industry that is quite well graphically animates the appearance and behavior of such creatures. However, engineered such biomimetic intelligent creatures as realistic robots is still challenging due to the need to physically and technological constraints. [2]

3.2. Artificial muscles:

Muscles are the key to the mobility and manipulation capability of biological creatures and when creating biomimetic it is essential to create actuators that emulate muscles. The potential to make such actuators is increasingly becoming feasible with the emergence of the electro active polymers (EAP), which are also known as artificial muscles [Bar-Cohen, 2001]. These materials have functional similarities
to biological muscles, including resilience, damage tolerance, and large actuation strains. Moreover, these materials can be used to make mechanical devices with no traditional components like gears, and bearings, which are responsible to their high costs, weight and premature failures. The large displacement that can be obtained with EAP using low mass, low power and, in some of these materials also low voltage, makes them attractive actuators. The capability of EAPs to emulate muscles offers robotic capabilities that have been in the realm of science fiction when relying on existing actuators.

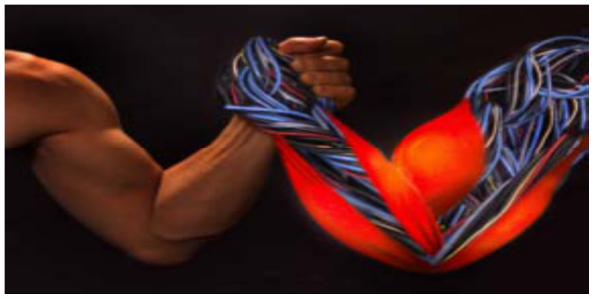

Figure 1: A Graphic Illustration of the Grand Challenge for the Development of EAP Actuated Robotics – An Arm Wrestling Match against Human.

Unfortunately, the EAP materials that have been developed so far are still exhibiting low conversion efficiency, are not robust, and there are no standard commercial materials available for consideration in practical applications. In order to be able to take these materials from the development phase to application as effective actuators, there is a need for an established infrastructure. For this purpose, it is necessary to develop comprehensive understanding of EAP materials' behavior, as well as effective processing, shaping and characterization techniques. The technology of artificial muscles is still in its emerging stages but the increased resources, the growing number of investigators conducting research related to EAP, and the improved collaboration among developers, users, and sponsors are leading to a rapid progress.

3.3. Responsibility of AI Research and Development

The question that concerns many in regards to the development of machines capable of intelligence comparable to that of a human being, is that of the consequences of creating servants capable of becoming masters. This is a question in itself contains many more: How much power will these machines - (robots, as many like to think of them) have? Who is going to control them? What are they going to be used for? What responsibilities will they carry? These are just a few of the questions, which are on the minds of many who ever stopped to think what AI is about. Robots, which could build other robots, tried to protect humans from everything until people could not do anything by themselves. They became totally dependent on the machines. The creator of these robots could not destroy them because they would keep him away from doing so. After all how could they protect people after they would be destroyed? How much responsibility and authority should these machines have? This question becomes even more important when one considers a fact that one of the biggest supporters of AI research is military. One of the reasons is that in "...a nuclear age, a new generation of very intelligent computers incorporating AI could actually defend the country better, faster, and more rationally than humans."4 Even if this is true we do not think that a machine should handle the responsibility for the fate of human civilization, no matter how intelligent it is.

4. Biometric robots using EAP:

Mimicking nature would significantly expand the functionality of robots allowing performance of tasks that are currently impossible. As technology evolves, great number of biologically inspired robots actuated by EAP materials emulating biological creatures is expected to emerge. The challenges to making such robots can be seen graphically in Figure 2 where humanlike and dog-like robots are shown to hop and express joy. Both tasks are easy for humans and dogs to do but are extremely complex to perform by existing robots.

4.1. Remote presence via haptic interfaces:

Remotely operated robots and simulators that involve virtual reality and the ability to “feel” remote or virtual environment are highly attractive and offer unmatched capabilities. To address this need, the engineering community is developing haptic (tactile and force) feedback systems that are allowing users to immerse themselves in the display medium while being connected thru haptic and tactile interfaces to allow them to perform tele presence and “feel" at the level of their fingers and toes. Recently, the potential of making such a capability with high resolution and small workspace was enabled by the novel MEMICA system (Mechanical Mirroring uses Controlled stiffness and Actuators) For this purpose, a scientist at JPL and Rutgers University used an EAP liquid, called Electro-Rheological Fluid (ERF), which becomes viscous under electro-activated. Taking advantage of this property, they designed miniature Electrically Controlled Stiffness (ECS) elements and actuators. Using this system, the feeling of the stiffness and forces applied at remote or virtual environments will be reflected to the users via proportional changes in ERF viscosity.

5. Biologically inspired robots

The evolution in capabilities that are inspired by biology has increased to a level where more sophisticated and demanding fields, such as space science, are considering the use of such robots. At JPL, a six-legged robot is currently being developed for consideration in future missions to such planets as Mars. Such robots include the LEMUR (Limbed Excursion Mobile Utility Robot). This type of robot would potentially perform mobility in complex terrains, sample acquisition and analysis, and many other functions that are attributed to legged animals including grasping and object manipulation. Equipped with multifunctional tools and multiple cameras, the LEMUR robots are intended to inspect and maintain installations beyond humanity's easy reach in space with the ability to operate in harsh planetary environments that are hazardous to human. This spider looking robot has 6 legs, each of which has interchangeable end-effectors to perform the required mission (see Figure 4). The axis symmetric layout is a lot like a starfish or octopus, and it has a panning camera system that allows omni-directional movement and manipulation operations.

Figure2: An Android Head and a Robotic Hand that are Serving as Biomimetic Platforms for the Development of Artificial Muscles.

6. Remote Presence via Haptic Interfaces:

Remotely operated robots and simulators that involve virtual reality and the ability to "feel" remote or virtual environment are highly attractive and offer unmatched capabilities To address this need, the engineering community are developing haptic (tactile and force) feedback systems that are allowing users to immerse themselves in the display medium while being connected thru haptic and tactile interfaces to allow them to perform tele presence and "feel" at the level of their fingers and toes.[3] Recently, the potential of making such a capability with high resolution and small workspace was enabled by the novel MEMICA system (Mechanical Mirroring uses Controlled stiffness and Actuators) For this purpose, scientist at JPL and Rutgers University used an EAP liquid, called Electro-Rheological Fluid (ERF), which becomes viscous under electro-activation. Taking advantage of this property, they designed miniature Electrically Controlled Stiffness (ECS) elements and actuators. Using this system, the feeling of the stiffness and forces applied at remote or virtual environments will be reflected to the users via proportional changes in ERF viscosity.

Figure 3: Making a joyfully hopping human-like and dog-like robots actuated by EAP materials are great challenges for biometric robots

Figure 4: A new class of multi-limbed robots called Lemur (Limbed Excursion Mobile Utility Robot) is under development at JPL.

7. Robots as Part of the Human Society:

As robots are getting the appearance and functionalities of humans and animals there is a growing need to make them interact and communicate as a sociable partner rather than a tool. This trend is requiring that robots would be able to communicate, cooperate, and learn from people in familiar human-oriented terms. Such a capability poses new challenges and motivates new domestic, entertainment, educational, and health related applications for robots that play a part in our daily lives. It requires obeying a wide range of social rules and learned behaviors that guide the interactions with, and attitudes toward, interactive technologies. Such robots are increasingly emerging and one example of such a robot is the Kismet that was developed by Breazeal [2002]. Kismet perceives a variety of natural social cues from visual and auditory channels, and delivers social signals to people through gaze direction, facial expression, body posture, and vocalizations. Natural language processing will provide important services for people who speak different languages. If a computer is able to understand natural languages, it will also be able to translate from one language to another. The "universal translator" widely used Star Trek may actually become a reality! This, of course, also includes voice recognition, or speech recognition. One of the big problems of humankind is that people start thinking only after they get into trouble. People like to invent new things but most of the time they never stop to think about consequences of their inventions. We think that now is the time to raise the question about Artificial Intelligence: "Should we do it?". As we have already mentioned, there are a lot of ethical and moral problems which could arise with the future development of Artificial Intelligence. Even though there are a lot of advantages of using Artificial Intelligence in the future, there are still big obstacles which should make us hesitant to develop or use robots in our lives. Some may argue that this does not have to be true and all people will be happy and have a lot of free time to spend with their families and for leisure. But others will quote Marx and say: "Labor is what makes a man human." These people will argue that people will become dependent on AI, and they will loose the ability to provide for themselves, or even the ability to reason. Then humanity would be reduced to the primordial animal state.

7.1. Future of Artificial Intelligence: should we do it?

What kind of developments should we expect in the area of Artificial Intelligence? Judging from the research topics that we have today, we might predict that in the near future things such as object recognition, voice recognition, and natural language understanding will be a reality. Will there be systems so advanced that they have to be given rights similar to those of humans? Probably not in the foreseeable future. But maybe in a little more than half a century, if the humanity survives that long, such machines may very well develop.

7.2. What kind of advantages would future Artificial Intelligence systems offer?

They will probably be increasingly used in the field of medicine. Knowledge based expert system, which can cross-reference symptoms and diseases will greatly improve the accuracy of diagnostics. Object recognition will also be a great aid to doctors. Along with images from cats' cans or X-ray machines, they will be able to get preliminary analysis of those images. This of course will be possible only if people solve legal questions that arise by giving power to a machine to control or influence the health of a human. The most difficult question arises when we start to think about long term goals. Do we want to build a computer which will be like us? If we do, what do we need them for? What will these human-computers do for humanity? Nobody has an answer to these questions and we can only speculate about the consequences. What is even more important, scientist will

not stop to try to achieve more and more every year. We will just have to live and see what the future of Artificial Intelligence and the future of Human existence will be like. Idea of Artificial Intelligence is being replaced by artificial life or anything with a form or body. The consensus among scientists is that a requirement for life is that it has an embodiment in some physical form, but this will change. Programs may not fit this requirement for life yet.

7.3. Applications-The potential applications of Artificial Intelligence are abundant. They stretch from the *military* for autonomous control and target identification, to the *entertainment industry* for computer games and robotic pets. Lets also not forget big establishments dealing with huge amounts of information such as *hospitals*, *banks* and *insurances*, who can use AI to predict customer behavior and detect trends.[4]

7.4. Disadvantages:

Potential for malevolent programs, "cold war" between two countries, unforeseen impacts because it is complex technology, environmental consequences will most likely is minimal. Self-modifying, when combined with self-replicating, can lead to dangerous, unexpected results, such as a new and frequently mutating computer virus. As computers get faster and more numerous, the possibility of randomly creating an artificial intelligence becomes real. Military robots may make it possible for a country to indiscriminately attack less-advanced countries with few, if any, human casualties. Rapid advances in AI could mean massive structural unemployment.AI utilizing non-transparent learning (i.e. neural networks) is never completely predictable.[5].

8. Conclusion

When programs that appear to demonstrate sentience appear (intelligence and awareness), a panel of scientists could be assembled to determine if a particular program is sentient or not.

If sentient, it will be given rights, so, in general, companies will try to avoid developing sentient AI since they would not be able to indiscriminately exploit it.

Software companies should be made legally responsible for failings of software that result in damage to third parties despite good-faith attempts at control by the user.

AI and robotics have the potential to truly revolutionize the economy by replacing labor with capital, allowing greater production—it deserves a corresponding share of research funding!

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A Hybrid Medical Image Classification Approach for Inferior Alveolar Nerve Injury (IANI) Identification

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Abstract— This paper proposes a feature selection based classification method that can be applied to better accuracy in the Digital Radiographs (DR) for the identification of Inferior Alveolar Nerve Injury (IANI). Different conventional features based on the shape and EZW (Embedded Zero tree Wavelet) based texture features are extracted using different feature extraction techniques. Find the global optimum to get the reduced feature using Particle Swarm Optimization (PSO) method. Finally, Multilayer Perceptron (MLP) classifier is trained using reduced features to classify the IAN (Inferior Alveolar Nerve) injured on a healthy object. The proposed classification results are compared with PCA-DT and PCA-MLP classification algorithms. Both training and testing stages of proposed model get better classification accuracy of 88.7% and 80.71% respectively. This shows the highest classification accuracy performance among some other existing methods.

Index Terms—Digital radiographs, Feature selection, Image Classification, Inferior Alveolar Nerve Injury, Multilayer Perceptron, Particle Swarm Optimization.

1. Introduction

Medical demands have driven the fast growth of medical image processing methods, which in turn have significantly promoted the level of the therapeutic process. They have become essential tools for diagnosis, treatment planning and authentication of administered treatment. Therefore, the technology of medical image processing has long attracted attention of relevant experts. Regularly, Orthopantomography (OPG) is used for dentist, for the reason that it imparts clarity of skeletal formation of entire teeth and temporo-mandibular joints.

A dental implant is surgically inserted in the jawbone as an artificial root onto which a dental prosthesis is placed [1]. The major problematical significance of dental implantation is Inferior Alveolar Nerve injury (IANI). These injury results in fractional or absolute loss of consciousness from the ipsilateral skin of the lower lip and cheek, the buccal oral mucosa in this area and the lower teeth. Causes of IANI include placement of dental implants, local anesthetic injections, third molar surgery, endodontic, trauma and orthognathic surgery. Most patients who extend an IANI gradually get back to regular consciousness above the path of a few weeks or months, depending upon the nerve damage severity. Nevertheless, after the most rigorous injuries, where fraction/fracture or all of the nerves have been sectioned and the place may have been compromised by infection, revival will be imperfect. Hence, IAN detection is necessary while by preparation of preoperative for dental implantation.The sensory innervations on lower lip and teeth via Inferior Alveolar Nerve (IAN) [2]. It traverses the lower mandibular bone into Inferior Alveolar Canal (IAC) in Figure 1. It can be identified using radiographic images.The IAC is outlined by two thin radiopaque outlines to signify the cortical walls of the canal. IAC appears lower or superimposed above the apex of the mandibular molar teeth [3]. Thus, the majority of earlier researches on the IAC detection [4] involve manual involvement to indicate the canal. Damage to the IAN can produce extremely severe difficulty [5].On panoramic Digital Radiography (DR) observation, the root apex of the mandibular second molar was in close propinquity to the mandibular canal while the apices of themesial and distal roots of the mandibular first molar were the farthest from the canal [6].Radiological prediction of injury to the IAN depends on the relationship of the root to the canal discussed by Malik [7]. Rood and Shebab [8] has defined seven vital recommendations that can be taken from OPG images. There have been numerous OPG evaluation researches which keep the helpfulness of these seven recommendations [9] in Table I. Nowadays, research determined that major threaten is darkening of the root is closely related to cortical bone loss and/or grooving of the root [9].

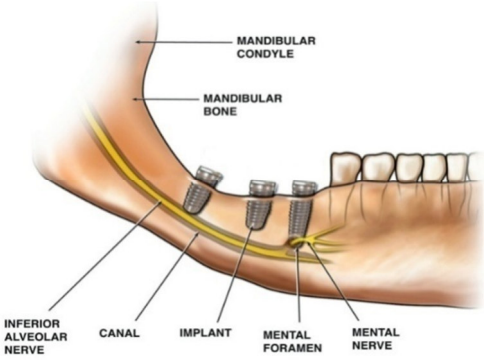

Figure 1. Anatomy of IAN

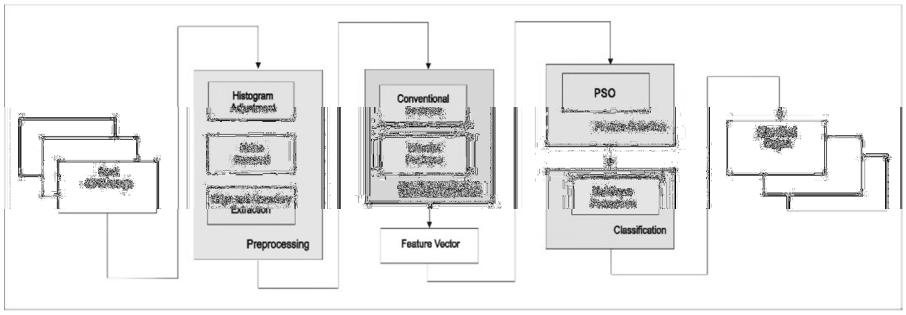

Figure 2. Proposed Work Framework

TABLE I. IAN INJURY IN OPG IMAGE [9]

OPG Imaging Procedure	Sensitivity (%)	Specificity (%)
Darkening of the root	32-71	73-96
Interruption of the canal	22-80	47-97
Diversion of the canal	3-50	82-100

Image classification [10] automatically assigns an unknown image to a category according to its visual content, which has been a major research direction in computer vision. Feature extraction step disturb the whole further consequent procedure. Normally, Digital X-ray images are gray level images. So, the image analysis deal with textures for feature extraction process which were used by several researchers [11–14]. A multi-visual feature mixture such as GLCM [15], canny based shape feature and pixel value was presented by Mueen et al. [16]. Texture analysis has a major role for medical image analysis. GLCM histogram has extracted the feature vector used for Digital Radiograph (DR) analysis by Yu.et.al [11]. Texture based geometric pattern feature analysis method to analyze the DR developed by Katsuragawa et al. [12]. GLCM and embedded zero tree wavelet features are extracted using PCA-DT classification method in [13]. PCA-MLP classification method has proposed in [14] using embedded zero tree wavelet and GLCM features. From a classification point of view, Multilayer Perceptron (MLP) is a well-liked method for neural network based classification [17]. F. Ghofrani et. al [18] proposes a novel approach for medical x-ray image classification using k-nearest neighbor (K-NN) classifiers. A hybridization of Particle swarm optimization with the back propagation learning based Multilayer perceptron neural network has been proposed C. Prasad et.al [19]. Therefore, in this work MLP is used as a classification tool.

2.Proposed Methodology

The Proposed framework divided into four parts like Preprocessing, Feature Extraction, Feature Selection and Classification shown in Figure. 2.

A. Preprocessing

It consists of normalizing the intensity variations, low contrast, removing low frequency noise and exclude impressions. This step is a major role in the perfect and precise extraction of features. Histogram adjustment, noise removal and canny based edge extraction are sublevel of this process.

i. Histogram Adjustment and Noise Removal

It is used to emphasize and highlight the details of input images and to justify their gray level histogram [20]. To get rid of noise and unnecessary information, the anisotropic diffusion filter as proposed in [21] is utilized. This filter removes the noise from input image while preserves important parts of image contents such as edges and major boundaries. The filtered image is modeled as the solution to the anisotropic diffusion equation.

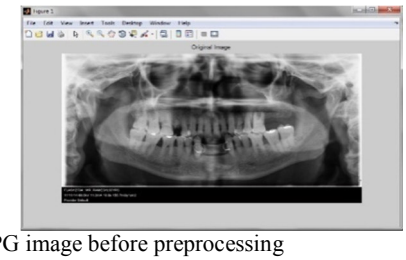

Figure 3. OPG image before preprocessing

ii. Edge and Boundary extraction

An edge gives us an object layout. Identifying the pixel value and it is compared with the neighboring pixels to be outlined as edge regions [22]. All objects in the image are outlined when the intensities are measured exactly [23]. In order to extract the edges and boundaries from images, canny edge detection algorithms [22] is utilized. In Canny edge detection procedure for segmentation shows in Fig. 4.

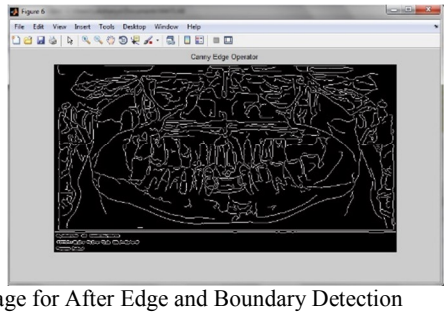

Figure 4. OPG image for After Edge and Boundary Detection

B. Feature Extraction

Mostly, image classification uses low level features color, shape and texture. But, DR images are mainly in grey level. So, color is not suitable feature for DR analysis. Then, shape and texture can be considered for DR analysis [12]. Here, there are 383 features are extracted from each DR image.

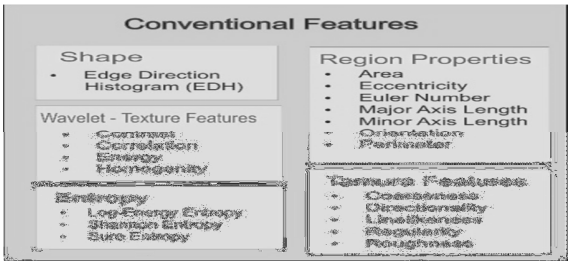

Figure 5. Conventional features

Here, we extracted the conventional features in Figure. 5 as follows: Shape, Region properties, Tamura features, entropy and Wavelet based Texture Features for two-Dimensional level discrete wavelet transform for four (LL, LH, HL and HH) sub-bands in θ directions (θ=0°, 45°, 90°, 135°). The following Texture features are extracted [24] like Energy ($k1$), Local variations ($k2$), Correlation ($k3$) and Homogeneity ($k4$).

$$k1 = \sum_{i=0}^{N-1} \sum_{j=0}^{k-1} p_{\mu}^{2}(i, j) \quad (1)$$

$$k2 = \sum_{t=0}^{N-1} t^{2} \left\{ \sum_{i=0}^{N-1} \sum_{j=0}^{k-1} p_{\mu}^{2}(i, j) \right\} \quad (2)$$

$$k3 = \sum_{i=0}^{k-1} \sum_{j=0}^{k-1} \frac{(i, j)\, p(i, j) - \mu_1 \mu_2}{\sigma_1^2 \sigma_2^2} \quad (3)$$

$$k4 = \sum_{i=0}^{k-1} \sum_{j=0}^{k-1} \frac{p_{\mu}(i, j)}{1 + (i - j)^2}, i \neq j \quad (4)$$

Wavelet transform can capture both frequency and spatial information and has merits of multi-resolution and multi-scale decomposition [25]. In our study, the selected well-known Zero tree Wavelet as the wavelet base, which may provide a more effective analysis than others in the scenario of image processing. This transformation is theoretically lossless, although this may not always be the case. The purpose of the transformation is to generate decorrelated coefficients, which means it removes all the dependencies between samples.The EZW algorithm applies Successive Approximation Quantization in order to provide multi-precision representation of the transformed coefficients and to facilitate the embedded coding. The algorithm codes the transformed coefficients in decreasing order in several scans. Each scan of the algorithm consists of two passes: significant map encoding and refinement pass. The dominant pass scans the subband structure in zigzag, right-to-left and then top-to-bottom within each scale, before proceeding to the next higher scale of subband structure as presented in Figure 6.

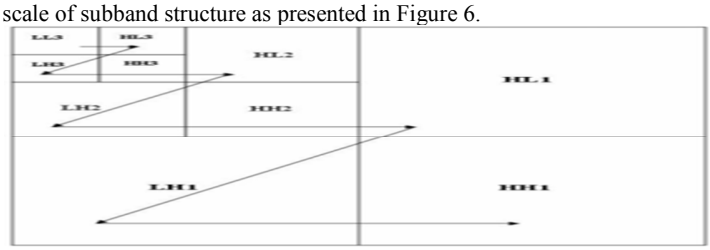

Figure 6. EZW sub band structure scanning order

C. Feature Selection

Feature selection [17] retains higher accuracy at the use of minimal feature subset. It can be able during wrapper and filter methods. Wrapper methods are computationally costly and more time consumable. Here, Particle Swarm Optimization (PSO) algorithm is used as a feature selection method [17-19].

i. Particle Swarm Optimization (PSO)

It is a theoretical, population based optimization technique planning to discover the optimization result in a search space [26]. It is accomplished of simulate the capability of human societies to development information [27]. It has roots in two major component methods like artificial life and evolutionary computation [27]. Fitness function is the most important purpose of using PSO. Table II shown the Number of features selected based on the feature selection methods.

TABLE II. SUMMARY OF FEATURE SELECTION

Feature Selection Methods	Number of Features Selected
Before Feature Selection	383
PCA	41
PSO	45

D. Classification

Neural networks units can be classified into numerous layers [28]. The initial and final layers are called as input and output layer respectively. The transitional layers are called as hidden layers. Every element procures several data from other elements and processes this data, which will be converted into the final element. The object of the system is to find out various associations among initial and final patterns [19]. The modification of the connection weights between units achieved by the learning process.

The various types of neural networks based on their structures are

- Single layer perceptron,
- Multi-layer perceptron(MLP),
- Back propagation net,
- Hopfield net and
- Kohonen feature map.

MLP is recognized as the best ANN used in classification from examples [29]. In this work, the MLP with back-propagation (BP) supervised learning algorithm is used for experimentation. It has two pass phases, forward and backward pass phase. Feed forward propagation of input pattern signals through network is used by Forward pass phase. It calculated by 'functional signal'. Backward pass phase propagates the error backwards through network starting at output units. It estimates by 'error signal' .In our proposed system the classification has two stages, training and testing stage. Various features are extracted from OPG image to Identification of IAN in training stage. In testing stage based on the knowledge base, the classifier classifies the image into IAN- identified and not identified images. Section III shows the Proposed Hybrid PSO-MLP algorithm model for feature selection based classification algorithm.

3.Experimental Results and Discussions

A. *Data Description*

TABLE III. SUMMARY OF EXPERIMENTAL DATA

Patient Age (Years)	Sex	Number of Patients	Number of DRs	Data Dimensions
10 – 75	Male – 62 Female – 38	100	140	1024 X 564 X 24

Here, 140 OPG DRs collected from MSR Tooth Clinic, Madurai which is composed of 62 OPG radiographs for male patients of age of 10 to 75 years old and 38 for female patients of age of 12 to 74 years old. Around 40 OPG radiographs are posterior dental implants for accuracy of implant position and injuries of IAN. The diagnostic decisions of all the 100 patients were made by a radiologist panel. Table III and IV shows the summary of experimental data of OPG image and Patients Data Summary with Sex and Age Range.

TABLE IV. PATIENTS DATA SUMMARY WITH SEX AND AGE RANGE

Age Range	Male	Female	Total
10 to 20	15	8	23
21 to 35	27	20	47
36 to 50	22	17	39
51 to 65	10	8	18
66 to 75	9	4	13
Total	83	57	140

B. Performance Assessment

In this study, classification accuracy, sensitivity and specification were used as assessment of the proposed Hybrid PSO-MLP model. It defined in Equation (6), (7) and (8).

$$Accuracy = \frac{TP + TN}{TP + FN + TN + FP} \times 100\% \quad (6)$$

$$Sensitivity = \frac{TP}{TP + FN} \times 100\% \quad (7)$$

$$Specificity = \frac{TN}{TN + FP} \times 100\% \quad (8)$$

where TP(True Positive) denote the number of correctly classified IAN injured object, TN(True Negative) denote the number of correctly classified healthy object, FP(False Positive) denote the number of normal cases incorrectly classified. IAN denotes injured object and FN (False Negative) denotes the number of irregular objects incorrectly classified as normal object.

C. Comparison of Classification Results

The experimental results from the proposed technique are given in Table V and Table VI. The accuracy of proposed Hybrid PSO-MLP Model classification accuracy is better than existing model classifiers. Both training and testing phase of proposed model get better classification accuracy of 88.7% and 80.71% respectively. The graphical results of Figure 7, 8 and 9 shows the comparison of proposed results with existing Results [13, 14].

TABLE V. COMPARISON OF TRAINING RESULTS WITH DIFFERENT CLASSIFIERS

Feature Selection - Classifier	Classification Accuracy	Sensitivity	Specificity
PCA-DT [13]	82.3	76.2	85.2
PCA-MLP [14]	85.4	76.6	90.2
PSO-MLP (Proposed)	88.7	85.2	88.5

Above the experimental data in Table VI, we got the following results.

1. Not identified in IAN from medical experts 8.57%, but the proposed system has 3.57% only.
2. Partially identified in IAN, 17.86% for medical experts and 12.86% for the proposed system.
3. Partially identified in IAN, 17.86% for medical experts and 12.86% for the proposed system.

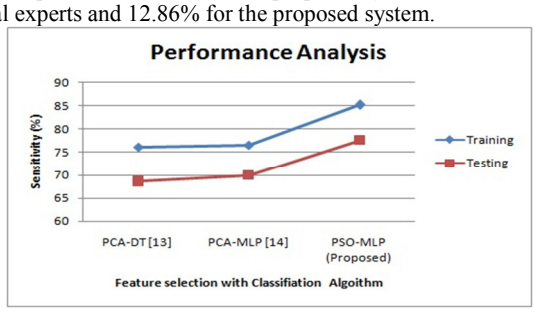

Figure 8. Performance analysis for Sensitivity for training and classification stage.

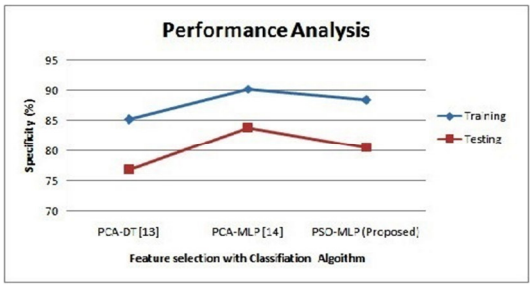

Figure 9. Performance analysis for Specificity for training and classification stage.

TABLE VI. COMPARISON OF DIFFERENT CLASSIFIER RESULTS WITH MEDICAL EXPERTS

IAN Identification	Medical Experts		PCA-DT		PCA-MLP		PSO-MLP	
	No. of Images	%	No. of Images	%	No. of Images	%	No. of Images	%
Not Identified	12	8.57	8	5.71	7	5.0	7	5.0
Partially Identified	25	17.86	22	15.71	22	15.71	20	15.29
Clearly identified	103	73.57	110	78.58	111	79.29	113	80.71

In Table VII to be discussed in the age range classification of IAN identification for Hybrid PSO-MLP Classification algorithmic approach. Below the age of 15 and more than 65, the age of visibility of IAN is very limited.

TABLE VII. SUMMARY OF IAN IDENTIFICATION FOR PSO-MLP CLASSIFIER

IAN Identification	Not Identified		Partially Identified		Clearly Identified	
	Male	Female	Male	Female	Male	Female
10 to 20	2	1	5	4	8	3
21 to 35	0	0	1	0	26	20
36 to 50	0	0	1	0	21	17
51 to 65	0	0	1	1	9	7
66 to 75	2	2	6	1	1	1
Total	**4**	**3**	**14**	**6**	**65**	**48**

4. Conclusion

In this paper, Hybrid PSO-MLP model based on EZW based texture and shape features are proposed. It was performed on a database consisting 140 DRs. By the aim of improving the classification accuracy, different conventional features are extracted. Then, hybrid Particle Swarm Optimization - Multilayer Perceptron model was used for feature selection and classification process. Experimental results shows that our method is an effective feature selection method obtain higher classification accuracy of other methods. Other performance analysis like sensitivity and specificity of our proposed model perform get better than other methods. The provided results show the effectively classify the IANI identification.

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Emotional Conversational Agents based on Cognitive Pragmatics

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Abstract:
This paper is an attempt to addresses one of the issues in building a conversational agent; which is the cognition behind the mind conversing.The focus will be on the working of mind that is involved in conversation. So to begin with we will discuss the existing model and then propose a model that helps I achieving our goal. Some of the cognition that may be required to achieve human like dialog system are goal, desire, belief, intention, compassion, pragmatics etc. This is just a preliminary approach to building such cognitive conversational agent architecture.

Keywords: Cognitive Architecture, conversational agents, emotion, cognitive pragmatics.

1. Introduction*:*

Conversational agents can be used for education, counseling, customer support, help desk, technical support kind of services. It also helps in training the customer service executives. Speech Recognition, Natural Language Processing and Cognitive Architecture all play a vital role in building a Conversational agent. Conversational agents which use computational linguistics techniques faces some technical challenges such accuracy and efficiency. (1) Two basic challenges in building a conversational agent are understanding agents1's conversation and acquiring language processing capabilities in agent2 to address agent1. These challenges can be addressed using Speech Recognition and NLP. These two techniques are used for answering only two questions such as 'What was told by Agent1?' and 'How to frame sentences to answer it?' But apart from these questions, we require Cognitive skills to answer the question 'What to say?' The answer for this question mainly depends on a number of cognitive aspects such as rational thinking, decision making, belief, etc.

A. II.Building a Conversational Agent:

1) In order to build an emotional conversational agent we need to observe the human conversation where communication is very effective even with lack of proper language skills. So after in-depth research I conclude that some of the components that are required to build human like conversational agent are Basic communication skills and Cognition from relevant Cognitive Architecture. Here there are various conversational agents build with Communication but cognition is not been researched sufficiently.Components involved in building a conversational agent are as follows:

a.Basic Components of Communication:

A conversational agent has to be built keeping in mind the above said techniques. The process of communication has three basic components namely Syntax, Semantics and Pragmatics. As a result of various researches, [Kelley, Jones, & Fein, 2004] the five components for the growth of linguistic proficiency are phonology, morphology, semantics, syntax and pragmatics. Phonology is the basic unit of sound, which is a subset of the sounds that humans are capable of producing. Morphology includes rules for using 'ed' and 's' as well as for using other prefixes and suffixes. Semantics refers to the meanings expressed in words, sentences and the smallest unit is known as morphemes. Syntax is the rules that specify how words are to be combined to form meaningful phrases and sentences. Pragmatics is the knowledge of language that might be used to communicate effectively e.g. The sociolinguistic knowledge. (2)Otherwise known as **Cognitive pragmatics**; it is the mental ability of human being which is used to communicate with each other. Linguist Noam Chomsky has proposed that humans come equipped with a language acquisition device. LAD is an inborn linguistic processor that is activated by verbal input. According to Chomsky, the LAD contains a universal grammar, or knowledge of rules that are common to all languages which is referred to as the nativist approach. (3)

In the Learning Perspective, Imitation and reinforcement are said to play a role in early language development. The Interactionist perspective says that the language development results from a complex interplay among biological maturation, cognitive development, and an ever-changing linguistic environment that is heavily influenced by the child's attempts to communicate with her companions.

b.Cognitive Pragmatics:

Cognitive pragmatics is the study of the mental states of people who are engaged in communication such as motivations, beliefs, goals, desires, and intentions.It is a new area where knowledge is acquired from the environment and agent's belief. Cognitive pragmatics involves various mental states irrespective of the approaches be it philosophical or psychological. Currently researches on cognitive architecture focus on BDI [Belief, Desire and Intention]. (5)This area is where my research will focus but with respect to communication between two perceptual agent. There are three levels in cognitive skills such as Cognition-the ability of the agent to compute, memorize, read, perceive, solve problems, etc; MetaCognition-the ability of the agent to monitor their own progress; Epistemic cognition- the ability of the agent to reflect on the limits of knowing, the certainty of knowing, and criteria of knowing. [26].Cognitive Pragmatics can be further classified into Epistemology and Ontology. Epistemology is the psychology of beliefs about knowledge and knowing that deals with the following: Perception, Memory, Reasoning, etc., whereas Ontology is the knowledge based on the previous experience [27]. Ontology is a specification of a conceptualization. Ontology is a description [like a formal specification of a program] of the concepts and relationships that can exist for an agent or a community of agents. [28]

C.Conversational Psychology:

A study also suggests that 'Baby talk key to Conversational Agent' (6) which clearly proves connection that exists between conversaional psychology and cognitive conversational agent. Chatrobots has evolved over the years from the simple conversational agent "Eliza". Professors from Osaka University has developed two models of robot named CommU and Sota which will act out programmed conversations. They say voice recognition was the most challenging part of developing a conversational agent. Robots struggle to respond due to the background noise. Thus conversational psychology is yet another area which should be referred for the development of conversational agent.

D.Cognitive Architecture:

Cognitive architectures play a vital role in providing blueprints for building future intelligent systems that thinks and acts like humans. Cognitive architectures are built on the bases of the agent's beliefs, its goals and the knowledge it had acquired over the period. It acquires knowledge of the

environment through perception and the knowledge about implications of the current situation through planning, reasoning. Cognitive architectures have a performance mechanism that utilize the acquired knowledge and the learning mechanisms that alter them. Other capabilities of a cognitive agent are decision making and problem solving. Thus an agent is build using a cognitive architecture and is said to be efficient if it can replace a human in a given environment. Communication is also an effective way for an agent to obtain knowledge is from another agent. Such agents are known as collaborative agents. Agents that uses cognitive architecture to converse with humans or other agents are cognitive conversational agents. Before discussing the criteria for building such agents, let us list out the cognitive architectures that may be considered.

SOAR [State Operator And Result]: SOAR cognitive architecture is based on the computational theory of human cognition. SOAR was introduced by Allen Newell, John Laird and Paul Rosen bloom in 1980. SOAR is well organized to produce a general intelligence. SOAR is considered as a symbolic artificial intelligence mechanism for understanding and simulating human mind. SOAR cognitive model exhibits flexible and goal driven behaviour. The knowledge of the model is continuously enhanced by learning. The major areas covered by unified theory of cognition are: perception, memory, problem solving, decision making, routine action, learning, language, motivations, emotion, motor behaviour, imaging, and dreaming.[13].

CogAff: CogAff is a generic cognitive architecture, and introduced by Sloman. The main aim of the cognition and affect architecture is to understand the different types of architectures based on human and nonhuman [minds] mental states, such as intelligent capabilities, moods, emotions, beliefs, thoughts, and desires. The Cognition and Affect project is concerned with understanding mechanisms of emotions, and to fit for cognitive models. Reactive layer includes a global alarm mechanism, which belongs to primary emotions. The deliberative layer supports for secondary emotions. Secondary emotions are semantically rich emotions. This layer is responsible for perception, planning, evaluation, allocation of resources, and decision making. This layer can learn the generalizations, and pass to the other layers. The meta management layer or reflective layer supervises, and controls the other layers of architecture, more efficiently. Sloman describes that; this layer can support and control the thoughts.[15].

EM-ONE architecture originated from Marvin Minsky"s "emotion machine" architecture. EM-ONE architecture was proposed by Minsky and his student Singh in 2005. According to Singh, EM-ONE architecture is an example for its predecessors Minsky and Sloman, and hence he called Minsky-Sloman Architecture. Main goal of EM-ONE cognitive architecture is to support human-level intelligence in systems. According to Singh his architecture refers to the "structure and arrangement of commonsense knowledge and processes". EM-ONE architecture for commonsense compu=]ting, that is capable of reflective reasoning about situations involving physical, social, and mental dimensions. EM-ONE architecture involves complex interactions among the several "actors" along with physical, social, and mental dimensions. [16].

SMCA: [Society of Mind approach to Cognitive Architecture] makes use of a generic architecture, and developed in terms of generic cognitive and metacognitive agent types. Each agent is designed to fit one of the following categories: reflexive agents, reactive agents, deliberative [BDI models] agents, learning, metacontrol and metacognitive agents. [18].There are only a very few cognitive architectures build for communication interms of conversation. Some of them are: [19]

NARS [Non-Axiomatic Reasoning System]: It is a reasoning system based on a language for knowledge representation, an experience-grounded semantics of the language, a set of inference rules, a memory structure, and a control mechanism, carrying out various highlevel cognitive tasks as different aspects of the same underlying process. [20].

SNePS [Semantic Network Processing System] is a logic, frame and network-based knowledge representation, reasoning, and acting system that went through over three decades of development. It stores knowledge and beliefs of some agent in form of assertions [propositions] about various entities The natural language processing system works with English morphological analyzer/synthesizer and generalized augmented transition network grammar interpreter. SNePS has been used for commonsense reasoning, natural language understanding and generation, contextual vocabulary acquisition, control of simulated cognitive agent that is able to chat with the users, question/answer system and other applications. Interesting inferences have been demonstrated, but the program has not yet been used in a large-scale real application.[21]

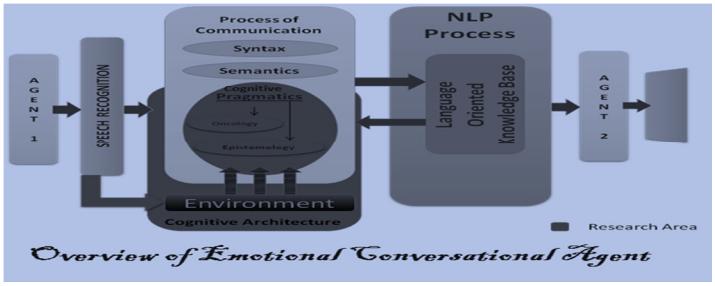
3.Other Conversational Agents:

Conversational agents can be classified into Embodied Conversational Agents and Disembodied conversational Agents. The first conversational agent or a chat robot was disembodied. The disembodied agents are those which interact with humans through speech or text entered at a keyboard; whereas the embodied agents are those interact with humans or robots with an animated avatar [7]. The challenge of embodied system is that they have to sense the human perception through facial expression, intonation, gaze direction etc. But in case of the disembodied agents the message is loud and clear and cannot be misunderstood.ELIZA was originally written by Michal Wallace and significantly enhanced by George Dunlop using Java Script. She is the oldest chat robot built in 1966. ELIZA emulates a Rogerian psychotherapist by only matching the keywords and substituting words with almost no intelligence. [8]Apart from Eliza there are other chatbots like Eliza1, Eliza2, Dr. Romulon a Pandorabot, MathBot that does Math etc. There is also a very interesting chatbot know as 'Chato' which also seems to be very intelligent. It uses AIML [Artificial Intelligence Mark up Language] and PHP. From Eliza to Chato we have definitely come a long way. [9].A.L.I.C.E. **/**Artificial Linguistic Internet Computer Entity**/** is an award-winning free natural language artificial intelligence chat robot. Its Alicebot engine uses AIML. One of its versions the Superbot was first released in the year 2005 consisting of over 120,000 patterns and responses. A mobile version is also available today for download. [10].

Rea is a life-size animated humanoid robot that can understand the conversations of the human standing in front of it using computer vision techniques. It observes their speech and behaviour and responds with appropriate speech, animated hand gestures, body movements, and facial expressions. The architecture for this new "conversationally intelligent" agent is based on an analysis of conversational functions, allowing the system to exploit users' natural speech, gesture and head movement in the input to organize conversation, and to respond with automatically generated verbal and nonverbal behaviours of its own. REA is one of the embodied conversational agents and is very close to conversational agents built using cognitive architectures.[7] Several versions of chatbox from CHATBOX1 to CHATBOX14 is available online as open source. But it uses database to store sentences and various searching techniques to process.[11].The Sociable Machines Project develops an expressive anthropomorphic robot called Kismet that engages people in natural and expressive face-to-face interaction. KISMET is inspired by infant social development, psychology, ethology, and theory of evolution. Kismet uses visual and auditory channels to perceive and learn from human conversations. The

expressions are mechanized using the theory of psychology that claims facial expressions have a systematic, coherent, and meaningful structure that can be mapped to affective dimensions. [12]Some of the other researches carried out currently on conversational agents at MIT are: Affective Intelligent Driving Agent, DragonBot[Android Phone Robots for Long-Term HRI], Global Literacy Tablets, [13].Illustrated in figure 1.

B.



C.

Figure.1.Proposed model of a Conversational Agent

This paper proposes a model of the Conversational Agent for communication between two perceptual agents keeping in mind all the various factors that are involved in developing a Conversational Agent as discussed above. My research emphasis is on the green area of 'Cognitive Pragmatics' which is developing a Conversational Agent based on Cognitive Architecture.

Therefore, my hypothesis is '***There is an internal cognitive system in a conversational agent that maps a syntactic structure to a semantic object'***.

***4*. Conclusion:**

Cognitive science research is highly interdisciplinary combining disciplines such as philosophy, psychology, Artificial intelligence, neuroscience, linguistics, and anthropology. Scientists in this field attempt to build computational models of human cognitive behavior in order to combine and verify the findings of the different disciplines. Emotions are increasingly seen as an important component of cognitive systems of humans as well as humanoids. With advances in computational linguistics, well-engineered conversational agents have begun to play an increasingly important role in the enterprise. By taking advantage of highly effective parsing, semantic analysis, and dialog management technologies, conversational agents clearly communicate with users to provide timely information that helps them solve their problems. Fig. Conversational Agent.[23].By making use of the agent's BDI-based reasoning, emotions must be incorporated into the conversational agents. Thus cognitive conversational agents are built, keeping in mind the mechanism to develop an effective conversational agent together with the cognitive concepts such as perception, decision making, reasoning, etc. In the future a cognitive conversational agent architecture suitable for building such conversational agent will be proposed.

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Wormhole Attacks in Mobile Cognitive Radio Networks

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Abstract
CRN is a self-configuring network of mobile nodes connected by wireless links—the union of which form an arbitrary topology. Individual nodes act as routers-- cooperate to forward both its own traffic as well as its neighbor's traffic. Minimal configuration and quick deployment make CRN networks suitable for emergency situations like natural or human-induced disasters, military conflicts, emergency medical situations etc. Such a network may operate in a standalone fashion, or may be connected to the larger Internet. All these features have helped CRN **gain popularity in the last decade.**
Keywords-Adhoc, Attacks, Nodes, Traffic, Security.

1.Introduction

Security is often necessary, and the weaknesses of a CRN need to be considered. The major weaknesses are the constrained bandwidth, processing power and battery power. The article presented a survey of the various attacks currently considered against CRN and summarized defenses that have been developed. Mobile CRN Networks (CRN) ,Group of mobile devices, No predefined infrastructure and No centralized administration[1].The advantages of the CRN are allowing them to be deployed much rapidly at low cost in a variety of applications.

2. Challenges

The salient features of CRN networks pose both challenges and opportunities in achieving these security goals use of wireless links renders a CRN susceptible to link attacks ranging from passive eavesdropping to active impersonation, message replay, and message distortion to achieve high survivability, CRN networks should have a distributed architecture with no central entities due to dynamic nature of CRNs, an a priori trust relationship between the nodes cannot be derived. It is desirable for the security mechanisms to adapt on-the-fly to these changes a CRN may consist of hundreds or even thousands of nodes. Security mechanisms should be scalable to handle such a large network. Security in CRN is an essential component for basic network functions like packet forwarding and routing. Network operation can be easily jeopardized if countermeasures are not embedded into their design[2].To secure an CRN network, the following attributes may be considered. Availability, confidentiality, integrity, authentication,Non-repudiation, Security exposures of CRN routing protocols are due to two different types of attacks:

Active attacks through which the misbehaving node has to bear some energy costs in order to perform some harmful operation and passive attacks that mainly consist of lack of cooperation with the purpose of energy saving. Nodes that perform active attacks with the aim of damaging other nodes by causing network outage are considered to be malicious. Nodes that perform passive attacks with the aim of saving battery life for their own communications are considered to be selfish. Selfish nodes can severely degrade network performances and eventually partition the network.[3].

2.1 Users

Disaster relief, Emergency operations, Military service, Maritime communications, Vehicle networks, Campus networks, Robot networks, etc.,

2.2 Diagrams

Has impact on nodes beyond just X and Y's neighbors, ROUTE REQUEST messages to set up best route from A to B.

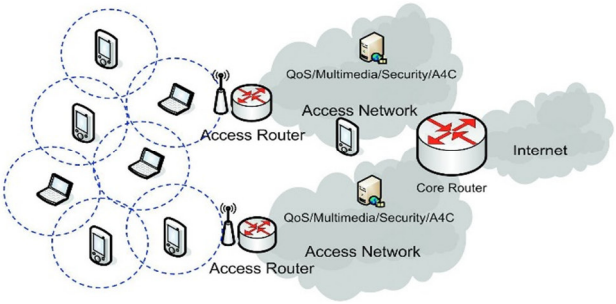

Fig.1. Wormhole Accesses

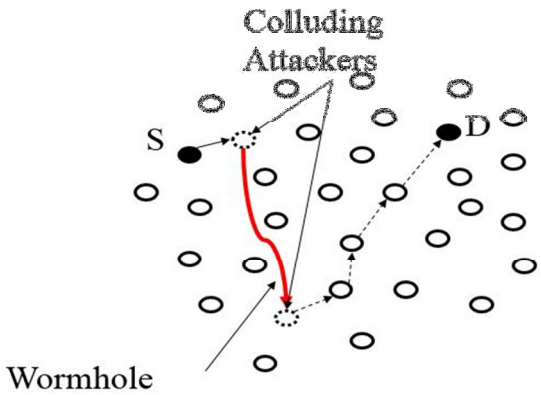

Fig. 2. Colluding Attackers in Wormhole

In a wormhole attack a malicious node can record packets (or bits) at one location in the network and tunnel them to another location through a private network shared with a colluding malicious node .Most existing CRN routing protocols would be unable to find consistent routes to any destination. When an attacker forwards only routing control messages and not data packets, communication may be severely damaged. Tunnel packets received in one place of the network and replay them in another place.[3]. The attacker can have no key material. All it requires is two transceivers and one high quality out-of-band channel. Wireless links are inherently vulnerable to eavesdropping and message injection. So, the attacker controls two powerful nodes that are located several hops away from each other .Because they are powerful, the two nodes can actually communicate directly. The attacker forwards packets through a high quality out-of-band link and replays them on the other end Causes routing problems, and enables DOS attacks to be set up.

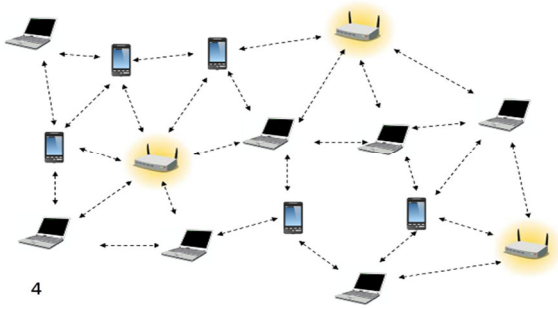

Fig.3. Attack through many media

Most packets will be routed to the wormhole [5].The wormhole can drop packets or more subtly, selectively forward packets to avoid detection. Attacker records a packet at one location in the network, tunnels the packet to another location, and then replays it there.[4].

Packets may be replayed from the far end of the wormhole. Puts attacker in a powerful position. Two powerful adversary nodes placed in two strategic location. Advertise a low cost path to the sink. All nodes in the network are attracted to them looking for an optimal route.This is attack is usually applied in conjunction with selective forwarding or eavesdropping attack. The two adversary nodes advertise a route that's two hops away.Normal route is longer, so it's not used. The adversaries are now in control of all the traffic in the network. Hard to detect because communication medium between the two bad nodes are unknown. Control and verify hop count. This limits the self-organizing criteria of an ad-hoc network. Use protocol that is not based on hop count. In geographic routing, a route is based on coordinates of intermediate nodes.[5]. But if adversary nodes can mimic its location, this doesn't work. Wormhole attack is a severe attack in which two attackers placed themselves strategically in the network. The attackers then keep on hearing the network, record the wireless data. Two colluding attackers have a high speed link between them. Any reqs that pass through the colluding nodes A1 and A2 will appear to cross the shortest path because of the high-speed link. This will cause S to send all messages to D through the compromised links A1 and A2.[2]

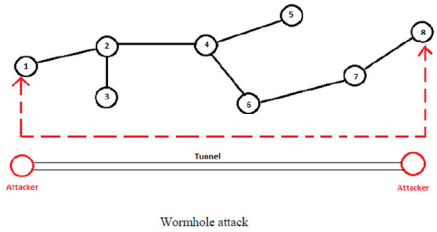

Fig.4. Wormhole attack through Tunnel

An attacker receives packets at one point in the network, "tunnels" them to a different point in the network and then replays them from this point. The attacker can create a wormhole for packets not addressed to itself so long as it is within hearing range.[6].

2.3 Advantage of wormhole attack

Mobility, Low cost, No need for existing infrastructure. Gives the attacker many advantages of power over the network [5].

Example 1: When used against DSR, each ROUTE REQUEST packet is tunneled directly to the destination target note of the REQUEST. All of the destination neighbors following normal routing protocol rebroadcast the REQUEST copy but discard without processing all other received ROUTE REQUEST packets originating from the same Route Discovery - essentially, routes greater than two hops are never discovered.[7]. The attacker can then discard rather than forward all data packets leading to DOS attack since no other route to the destination can be discovered as long as the attacker maintains the wormhole for ROUTE REQUEST. The attacker can also selectively modify or drop random bits of a data packet.

2.4 Countermeasures:

Packet leashes, temporal and geographical. Theprevent a packet from moving too far too fast.

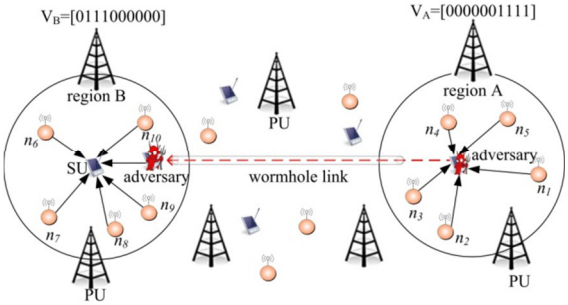

Fig.5. A Survey or wormhole based attacks

2.4.1. Simulation setup

In our evaluation, we consider the co-existence of a Cognitive Radio Network (CRN), a Primary Radio Network (PRN) and a Helper Node Network (HNN). The three co-existing networks are set up as follows:

Cellular PRN Setup: We consider the PRN to be a cellular network consisting of sixteen cells covering an area of 7 km x 7 km, as shown in Figure 5. We prefer the use of a cellular network over the recently opened TV white spaces due to the high dynamics of PU activity expected under a cellular scenario. To avoid interference between PUs, a separate set of frequency bands is assigned on adjacent cells. This assignment is performed according to the four color theorem [5], which guarantees that any planar map can be colored with at most four colors such that no two adjacent regions have the same color. [8].For the network considered in our simulations, three colors suffice. Figure 6Evaluation set-up consisting of a cellular PRN, CRN and HNN. 10 channels are assigned per channel. Adjacent cells do not share any channelsfrequency bands per cell according to the four color theorem is shown in Figure 6.1, where different shading patterns are used on various cells to indicate the corresponding frequencychannel assignments. Each cell is assigned 10 frequency bands, summing to a total of 30 bands for the entire PRN. The PU transmission radius is set to 1.5 km (transmission radiusfor cell towers is known to vary anywhere from 1 km to 30 km [55]). Calls arrive at each cell tower following a Poisson process with an average rate of λ calls/min. Each call lasts a fixed period of time equal to $\mu = 5$ min.[8]

3. Applications of the Wormhole Attack

Denial-of-Service - On-demand routing protocol such as DSR, AODV. Routing Disruptions - Periodic routing protocol such as DSDV, OLSR, and TBRPF. Unauthorized Access - Any wireless access control system that is based on physical proximity.

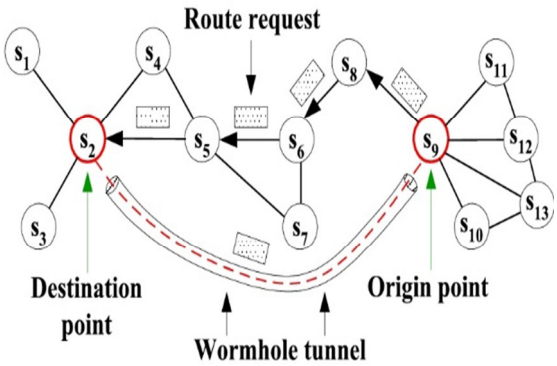

Fig.7. Process Diagram

4. Conclusion

Wormhole attack is a significant danger to routing protocols in CRN networks. Packet leashes have the ability to detect such attacks. Not for use in resource-scarce systems. Wormhole attacks - tunneling of packets by the attacker providing several advantages which could result in misleading route information as well as Denial-of-Service attacks .Directional antennas are less expensive than many localization mechanisms that also offer resistance to wormhole attacks Communication overhead is minimal loss of network connectivity .

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An Integrated Framework for Human Fall Detection and Recognition using Raspberry Pi

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Abstract
In recent years, falls are the major medical and social problem for elderly people who are living alone in home. This work represents the novel fall detection and recognition for elderly and older people living in a room environment, the identification of fall can be done using card sized processor Raspberry pi, multi-sensors and camera. A unified framework was developed by a U-Fall detection algorithm, which improves the sensor data more accurate and to achieve smart decision making. The U-Fall detection algorithm utilizes the collaborative manner between the server and edge device. However, in real world the communication between server and mobile devices were poor, due to excessive latency in networking and longer response time. To avoid these reasons a new paradigm provides the limited computing, storing, and network services in the way of distributed analytics between the devices and server.
Keywords:Raspberry Pi, U-Fall design method, Multi Sensor Fusion, Remote monitoring

1.Introduction

Understanding of human behaviour was becoming the most extensive and active manner to make the smart decisions in the data associated entities. In the biomedical research practise mainly focused on data driven era. Most of the fall detection applications which are employed by the inexpensive sensors that can collect the raw data are very complex in nature. This large volume of raw data will be analysed using U-fall implementation algorithm and then the revised data transmitted to the server in the cloud for the further smart decision making.With the help of Raspberry Pi camera a depth image can generated and structured whereas Pi camera are very insensitive to changes in light conditions and also it is difficult to provide 3D information towards distinguishing action.Most of the healthmonitoring applications will be employedfor high power consumption rate and wearable sensors that can monitor the input sensor information for different conditions in a smart living environment. Generally, huge amount of sensor information will be collected and imported to the network communicate server for future analysis.Real-world user experiences with mobile cloud based fall detection are very poor in network latency and response time. So to avoid such complications, U-fall implementation was a newly proposed architecture, utilizes the combination of server and mobile deviceswhich has a substantial amount of computing, storage, communication. This new computing paradigm opens an unprecedented opportunity to discover early predictors and novel biomarkers to support and enable smart care decision making in a connected health scenarios. In this paper, we employ a real-world fall detection application [10] (pervasive fall detection for stroke mitigation) to elaborate the effectiveness of computing application in health monitoring. The ultimate goal of our paper to reach a real-time device based smart decision making with low cost, and unobtrusive computing system for fall detection and recognition of elderly and aged people.Human action recognition application can used along with human computer interaction (HCI), it also include for application like surveillance, elderly people monitoring, and context aware computing. HCI [1-2] is also used for rehabilitation and body fitness training. While considering the human action recognition makes use of camera and wearable senor.

2.Raspberry Pi

The Raspberry Pi is a low cost, credit card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. Raspberry Pi is capable of little device that enables to explore computing, and can be programmed in many languages like scratch python, java. It is capable of doing everything you did expect a desktop computer to do, from browsing the internet to implementing real time applications for every field.

The Raspberry Pi 2 Model B is the second generation Raspberry Pi was used for this real time application. The Raspberry Pi is a 900MHz quad-core ARM Cortex-A7 CPU, with 1GB RAM, containing 4 USB Ports, 40 GPIO pins, Full HDMI port, Ethernet Port, Combined 3.5mm audio jack and composite video, Camera interface (CSI), Display interface (DSI) and Micro SD Card slot, Raspberry Pi has an ARMv7 processor, it can run the full range of Arm GNU/LINUX distributions, including Snappy Ubuntu core.

3.Implementation

Fall detection and Recognition of a person in a home based care environment frame work is shown in figure 1 using both wearable sensors and camera in this paper we are considering wearable sensors as Accelerometer sensor for identifying the Physical Falling, Passive Infra-red (PIR) sensors for posture recognition, Tilt sensor used to identify the movement of a person. Here the use of camera is to identify the movement of actions. The obtained sensor events are further extracted using the proposed algorithm U-fall implementation. The cameras inputs are taken from the Berkeley Human action Data base [3-4] the inputs stored in data base are numerical values of images which are captured from the camera. The obtained outputs are identified and the smart decision making of a particular fall is identified and alert was given to the caretakers.

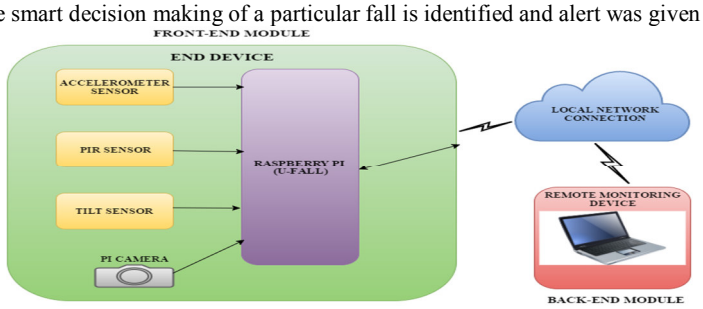

Figure: 1 Frame work for fall detection

4.U-FALL Design

Proposed system shown in figure 2uses two important principals spread network analytics and intelligence communication. Specially, the data analytics between smart devices and server in the cloud are separated by U-Fall implementation. The fall detection in U- fall is done by communicating between the edge devices and the resourceful cloud. Here smart phone uses for sensing and data capturing which is fully aware of both the front-end [6-7] and back-end running devices. Front-end is to run smart device and back-end can be connected via network, which is totally transparent to the user.

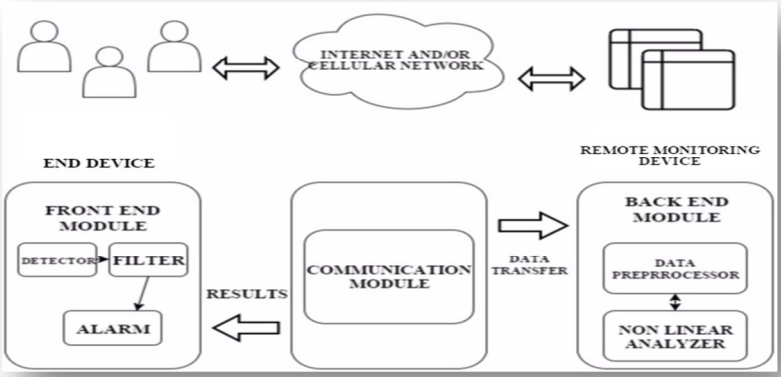

Figure: 2 U-FALL DESIGN

Front End Module:

Detection:

The U-fall implementation was enhanced by considering different variables, UP (observation made by true state), UQ (absolute value of noise), UR (priori error), US (previous estimate value), UT (absolute obtained value), UW (current running value), Uvar, and Uprocess are used for fusion process. Initially, to get an absolute result for fall happen UP, UQ, US, UT, UW are in zero condition and the random unknown values obtained by sensors are called as priori error. To avoid the priori error, here we are considering Uvar, and Uprocessin exponential form so the error can be filtered easily. If the priori error is very small we will ignore the current measurement and simply uses the past estimates. (US = UW), if the priori error is very large then the Uprocess will throw away the priori estimate and uses the current value (UQ=UP/(UP+uvar)). Finally the UQ is subtracted by UR and the obtained value is stored in UR so the absolute value of decision making will be given as result.

Back End Module:

Decision making:

Back End Module totally works by the server on cloud. It consists of two sub elements called Data Processor and Analyzer. Data processor is a processing component used to receive the fused data from the front end module. And Analyzer [8-9] performs the non-linear analysis for recognition based on the pre-processed data obtained by the decision making result. The decided result will be sent through the communication module via a local network to the front end module of remote monitoring device to make alert to the caretakers.

Result

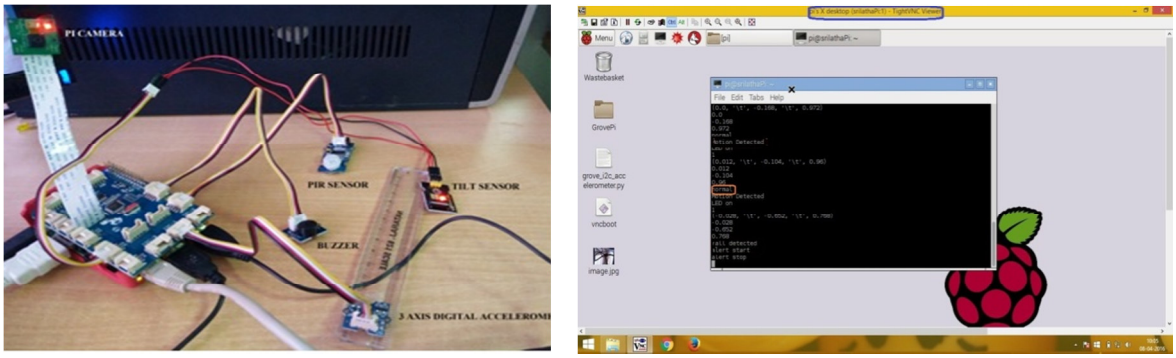

Figure: 3 Output when Fall Detected andmonitored on Desktop when Fall detected

Figure 3 and Figure 4 represents the output observed in remote monitoring device when fall observed by the user and when the person was in normal position. Here the remote monitoring device was used as a laptop of the user who is going to observe or monitor the Raspberry Pi which was placed in the patients place which is transperent to the user.

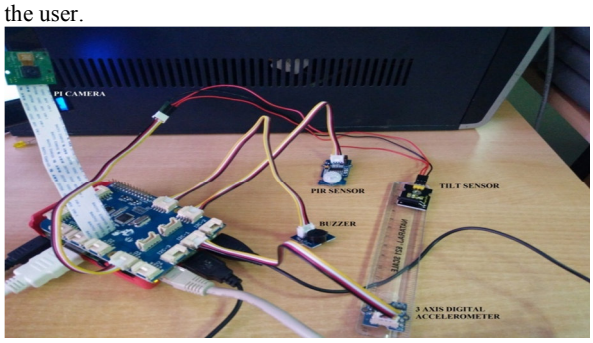

Figure: 4 Output when Person is inNormal Position and monitored on Desktop when person in Normal position

5. Conclusion and Future Enhancements

The proposed approach uses novel U-Fall detection method which correlates the data from multi sensor and takes the decision. The U-Fall detection algorithm was synchronized so that the multi sensor and Pi camera can be measured and explains how they are related. Status of a particular patient can be monitored and controlled using a simple tool so called as VNC (Virtual Network Computing) server and VNC (Virtual Network Computing) viewer. The U- Fall algorithms achieves less missing rates of fall and have a very low probability of making negative detection of a person. Meanwhile including U-Fall will give the clear analysis of combined sensors and prospect for the current situation and also for the future development of fall recognition algorithm for elderly people as well as health monitoring for different aged persons. The negative samples of sensor events can be avoided using the proposed algorithm so that the performance of sensitivity is higher than the specificity can be easily obtained by the calculated sensor and camera input functions. The power consumption is also very low because of Raspberry Pi and the processing Performance will be very high.

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Cluster based Key Management Authentication in Wireless Bio Sensor Network

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Abstract

A network comprising of several minute wireless sensor nodes which are organized in a dense manner is called as a Wireless Sensor Network (WSN). Bio sensors and systems have evolved to the point that they can be considered ready for clinical application. The use of Bio monitoring devices that allow continuous or intermittent monitoring of physiological signals is critical for the advancement of both the diagnosis as well as treatment of diseases. Bio systems are totally non-obtrusive devices that allow physicians to overcome the limitations of ambulatory technology and provide a response to the need for monitoring individuals over weeks or months. They typically rely on wireless miniature sensors enclosed in patches or bandages or in items that can be worn, such as ring or shirt. The data sets recorded using these systems are then processed to detect events predictive of possible worsening of the patient's clinical situations or they are explored to access the impact of clinical interventions usually; the sensor network consists of a huge group of distributed minimum power sensors disseminated over the area which is to be supervised. The sensors possess the capability of collecting the data, processing and then forwarding it to the central node for additional processing [2].The applications of WSNs include environmental monitoring, health, surveillance, catastrophe monitoring, structural monitoring, security, military, industry, agriculture, home, traffic monitoring, etc. A biosensor is any piece of hardware that interacts with a biological or physiological system to acquire a signal for either diagnostic or therapeutic purposes.

Keywords: Senor, Key, Wireless, Security, Protocols

1. Introduction

Every node estimates the state of its surroundings in this network. The estimated results are then converted into the signal form in order to determine the features related to this technique after the processing of the signals. Based on the multi hop technique, the entire data that is accumulated is directed towards the special nodes which are considered as the sink nodes or the Base Station (BS). The user at the destination receives the data through the internet or the satellite via gateway. The use of the gateway is not very necessary as it is reliant on the distance between the user at the destination and the network [1].Fig.1 demonstrates the architecture of wireless Bio Sensor Network. Data gathered using biosensors are then processed using biomedical signal processing techniques as a first step toward facilitating human or automated interpretation.When the sensor network is deployed in the battlefield, every data from sink node, reports of every data from sensor nodes to central node, message swapped between sensor nodes need to be encrypted for safeguarding the message from probable eavesdroppers [2].For supervising the physical world, the wireless Bio Sensor Network are the promising technology. In order to collect the data from the surrounding in a sensor network application, several minute sensor nodes are organized and collaborated. Sensing modals like image sensors are placed in every node and this possess the ability to communicate in the wireless environment. The major merit of WSN is that it minimizes the application cost by deploying the several sensors with minimum communication cost and with base station offering full network function. [3].

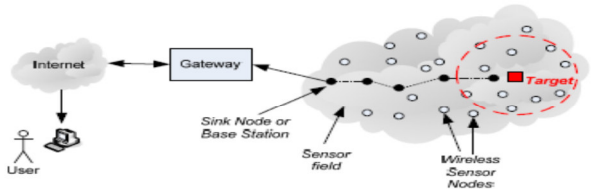

Figure 1: Architecture of wireless Bio Sensor Network

2. Attacks in Bio Sensor Network

As these handled systems include a display screen and a Random-Access-Memory (RAM) and can be connected to computers using wired data-links, wireless communication techniques do not play an essential role in most of these devices. In fact the wireless techniques are advantageous when information should be sent directly to the medical center to start decision making processes regarding an emergency or when continuous monitoring of the patients critical state is needed. To make a case for the usefulness of wireless data transfer one should consider the genetic sequencing that is emerging as the ideal method for disease diagnostics The attacks in Bio Sensor Network are normally categorized into following types.

Passive/Active: An active adversary prefers to hinder the process in all possible way. For example, altering the forwarded packet, purposely influencing the MAC layer collisions etc., A passive strategy frequently acts as originator of the active one. For example, looking for most efficient disruption of the network.

Insider/Outsider: This is a main perceptive feature. In every security application fields, insider problem prevails which offers a predominant undesirable problem. With the capacity of the insiders, the adversary can result in the latent damage. These issues are addresses by the researchers by considering threshold protocols for secret sharing and aggregating application protocols.
Static/adaptive: In obscure sense, there is a fairly random difference among them. A learning algorithm in a node is considered as static. In a realistic perspective, the capacity of every network to perform learning with respect to its surrounding causes more energy consumption [4].

Spoofed, Altered, or Replayed Routing Information

These types of attacks mainly point towards routing protocol which deals with routing information. Hence by altering the routing information of the routing protocol via malicious code, the complete routing information of the wireless Bio Sensor Network can be modified. The possible methods of performing this action are repeating routing information, limiting or lengthening the routes, spoofing the bogus messages, modifying the loops of routing, or enhancing the end-to-end delay in fig.2.

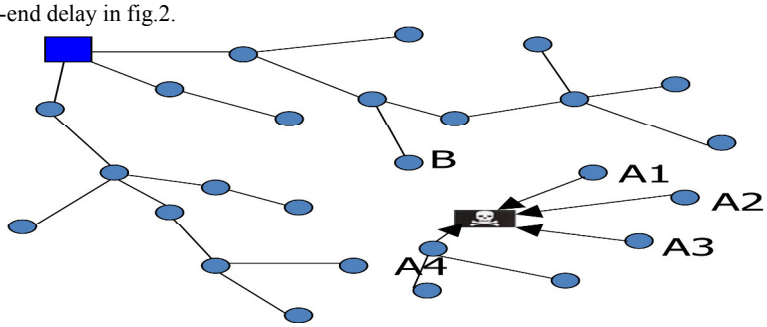

Fig.2.Example: captured node attracts traffic by advertising shortest path to sink, high battery power, etc

Selective Forwarding

The attacker attacks on one of the nodes and corrupt it using a malicious code. This node pretends to be normal node in WSN except that it drops the packets than forwarding the node in the path to the next node which means that it becomes the ineffective node.

Sinkhole Attacks

The main goal of the sink hole attacks is to excite all nodes in close proximity to builds a symbolic sink hole. For example, when one main coordinator is infected by the sink hole, every other node also drops into the sink hole subsequently. This attack gathers every attacking node to be viewed as ideal node for intending the neighboring nodes.

Sybil Attacks

During Sybil attack, the attacker corrupts a single node in the WSN network using malicious code covered with multiple characteristics. Subsequently this single node acts a main delay for the whole sensor network that further decreases the efficiency of fault tolerance techniques such as multi-path routing, upholding topology, etc.

Wormholes

In this type of attacks, the malicious node scoops the messages it received at one end of the network on a separate minimum-latency channel. After that, it reiterates the message at various points in the sensor network. Typically the wormhole attacks employ two different and distant malicious nodes for reducing the isolation from each other by repeating next to an out-of-reach channel which is just present in the attacker refer fig.3.

HELLO Flood Attacks

In several cases, the routing protocols in WSN needs nodes to distribute hello messages to declare themselves to their neighbors. Those nodes that obtain the message believe that it is within the radio range of the sender. But in some cases, this belief may be wrong. Since there is possibility that a lap-top class attacker broadcasting routing with more transmission power proves all other nodes that its neighbor is its attacker. It is not essential for the attacker to build justifiable traffic for using hello flood attack. It can just re-distribute the overhead packets with appropriate power to be gained by the every other node in the network.

Acknowledgement Spoofing

The numerous sensor network routing algorithms depend on implicit or explicit link layer acknowledgements. An adversary will be capable of spoofing link layer acknowledgements owing to the inbuilt broadcast medium, intended for overhead packets addressed to neighboring nodes. The main goal of this attack is to make the sender belief that weak link to be strong or that a dead or disabled node to be alive.

3. Network Security in Bio Sensor Network

In wireless channels, the communication is not completely secure and is subjected to security hazard. In the wireless channels, the possible security threat can be divided into two threats: inside threat and outside threat. In case of outside threat in the sensor network, the attacker does not possess control over the cryptographic materials. Whereas in case of the inside threat, the attacker will be possess some key materials and trust of some sensor nodes.
Compromising the sensor nodes is an easy task due to the absence of the expensive tampering resistant hardware. Even if it possesses the tampering resistant hardware, it may be very reliant. Modification, forging and discarding the messages is possible in case of a compromised node [5].In vulnerable locations, maintaining the security of the sensor nodes is a major task. In WSN, the encoding and the authentication of the communication carried out is necessary, to ensure security. For communication between the sensor nodes, few solutions have been developed to attain stability in

communication. Distribution key method, dissymmetric encryption method, and key predisposition method are the three kinds of key management techniques.
The attacks like jamming and spoofing are very destructive to the Bio Sensor Network. Whenever the cluster heads are responsible for the transmission and reception of the data, this nature of the promising key distribution networks makes it susceptible to destructive networks. So, the network will get destructed if a hacker tries to become the cluster head of the cluster. Examples of this type of attack are the selective forwarding and the sinkhole attacks.

4. Key Management in Wireless Bio Sensor Network

Use of the pair wise keys between sensor nodes is the necessary requirement of the WSN for ensuring security. The trusted-server scheme, the self-enforcing scheme, and the key pre distribution scheme are the three classes of the key agreement schemes. A trusted server is assumed to exist in the case of trusted-server scheme for the establishment of keys between the nodes. But in case of distributed Bio Sensor Network, trusted server scheme is not appropriate due to the difficulty in developing a trusted network. Asymmetric cryptography, like that of public key certificate is utilized in the self enforcing scheme. But for Bio Sensor Network, use of the public key algorithm is inappropriate due to the restricted amount of power and resources for computation in the minute sensor node. In the key pre-distribution schemes, loading of the keying materials takes place at a prior basis in the sensor nodes [6].In a wireless sensor network, the computation and communication capacity of every node is limited to a particular level. Node groups can be used for executing in network data aggregation and analysis. Refer fig.4.For instance, a vehicle can be tracked by a node group jointly via network. The nodes belonging to a group will keep varying repeatedly and at a faster rate in the network. In the wireless sensor network, most of the key services are executed by the groups. Hence, for admission of the new members to the group and to support group communication at a secure level, it is necessary to have a secure protocol for group management. After the computation within the group, the result is transferred to the base station. In order to ensure the transmission from a legitimate group, the result must be authenticated .More often the usage of the sensor network is in environment which is open and not well monitored. Key management has become a challenging task due to the numerous sensor nodes used and the reduced knowledge about the sensor node deployment abilities Impracticality of public key cryptosystems: The usage of the public-key algorithms, like that of Diffie-Hellman key agreement or RSA signatures is not desired due to the restricted ability of computation and restricted availability of the power resources in the sensor nodes. At present, the operations are executed by the sensor nodes over a time interval of seconds to minutes thus making it more prone to t he threats like denial of service (DoS) attacks in the network. Limited memory resources: Due to the limited memory of the sensor nodes, the key storage memory is also limited. Hence it is not possible to assign unique keys to each node in this network.

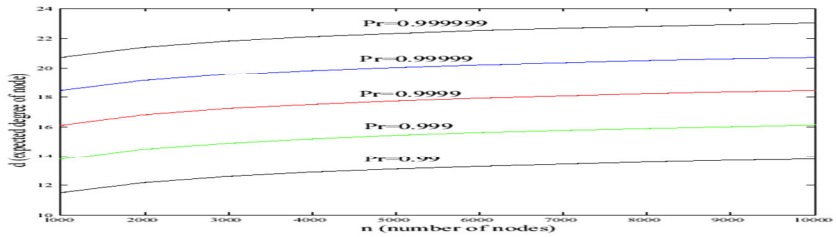

Fig.4 Expected degree of node vs. number of nodes, where P_c=Pr[G(n,p) is connected]

5. Authentication in Bio Sensor Network

The secured communication can be realized using user authentication concept. This constitutes three phases that are described as follows

1. Registration Phase: The user ID and password of the user is submitted to gateway node.

2. Login Phase: The user ID and password is submitted to the login node.

3.Authentication Phase: The user and timestamp's validity is verified by the gateway node [7].

The public key cryptography is used when there is large number of user due to its scalability. Since public key cryptography is more power consuming sensor communicates among each other with the help of symmetric cryptography. Thus the sensors in the communication range serve as promoters between public key cryptography of the user and symmetric crypto world of WSN. The user communicates to sensors with the help of public key cryptography and sensors communicate to the rest of the sensor network using symmetric cryptography and this process occurs in authenticate manner as follows.

6. Promising Key Management Protocols

This protocol is simple, elegant and provides effective tradeoff between robustness and scalability.
In this scheme a large pool of keys are generated (eg: 10,000 keys)
Randomly take 'K' keys out of the pool to establish a key ring (K << N)

Path Key Discovery: When two nodes communicate they search for a common key within the key ring by broadcasting their identities (ID's) of the keys they have.

6.1. Key ring and key pool size:

Due to the limited communication capabilities a number of nodes with which a particular node can communicate is n'<<n.This means that the probability of two nodes sharing at least one key in their key rings of size k is p'=d/(n'-1)>>p

Key pool size P can be derived as a function of k:

$$p' = 1 - \frac{(1-\frac{k}{P})^{2(P-k+1/2)}}{(1-\frac{2k}{P})^{(P-2k+1/2)}}$$

Consequently, the probability that no key is shared between the two rings is the ratio of the number of rings without a match by the total number of rings.

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$$p' = \frac{\binom{P-k}{k}}{\binom{P}{k}} = \frac{\frac{k!(P-k)!(P-k)!}{kP!k!(P-2k)!}}{\frac{(1-\frac{k}{P})^{2(P-k+1/2)}}{(1-\frac{2k}{P})^{(P-2k+1/2)}}}$$

6.2. Key management: constraints and Simulation results:

Refer Fig 5.a&b for Number of sensors to corrupt in order to compromise an arbitrary channel

Sensor node constraints:

Battery power

Transmission range

Memory

Temper protection

Sleep pattern

Network constraints:

Ad-hoc network nature

Packet size

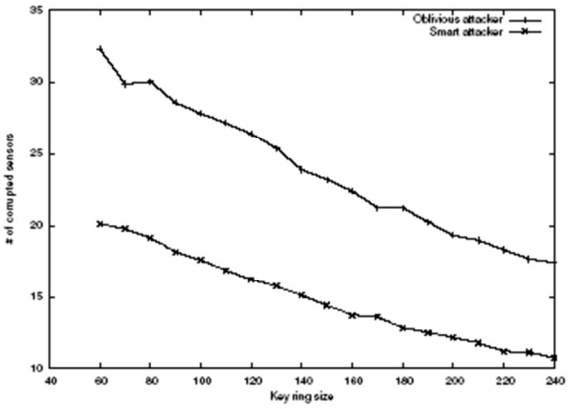

Fig.5 (a).Experimental results on challenge response: Number of sensors to corrupt in order to compromise an arbitrary channel.

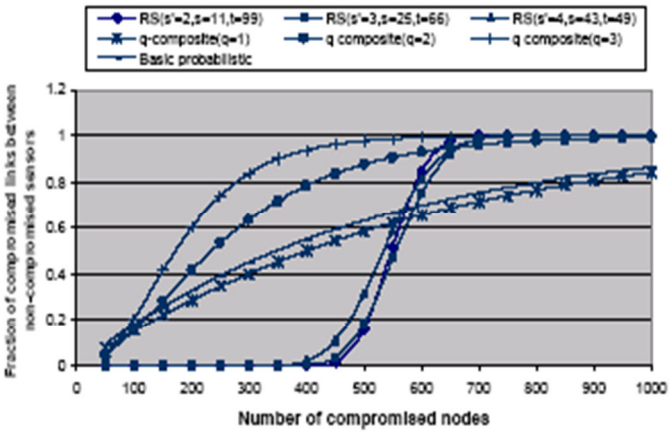

Fig.5 (b).Fraction of compromised links between non compromised nodes vs number of compromised nodes

6.3. Key management: evaluation/comparison metrics

Resilience against node capture: how many nodes are to be compromised in order to affect traffic of not compromised nodes? Addition: how complicated is dynamic node addition? Revocation: how complicated is dynamically node revocation? Supported network size: what is the maximum possible size of the network?

Note: since WSN can be used in a lot of different ways it is not reasonable to look for one key management approach to suite all needs: 20 000 node network deployed from the airplane over a battle field has quite different requirements.[6]

6.4. Performance Analysis: