



STATISTICAL APPROACH FOR DIAGNOSIS OF DISEASES USING HISTOPATHOLOGY DATA

L. MARGREAT¹ AND G. HARI KRISHNAN*²

¹Department of Mathematics & ²Department of Biomedical Engineering
Sathyabama University, Chennai

ABSTRACT

The incisional biopsy images of these types of diseases are diagnosed by specialist pathologist by observing the variation in shape, size, colour and density of particular object as the basic parameter. The final conclusion is based on pathological physician observation with his personal knowledge, clinical trials, experience and analytical ability. The conclusion given by a physician may vary with other physician due to the variation in knowledge, experience and analytical ability. The resultant of which may lead to wrong conclusion sometimes. To have a stable diagnosis with the assistance of expertise physician in pathology, an image processing tool has been developed using Matlab. The tool consists of Entropy Calculation, Highest Grey, Kurtosis calculation, Lowest Grey, Variance Calculation and STD calculation.

KEYWORDS: Histopathology; incisional biopsy, Pathologist, Statistical Analysis, Clinical trail.

*Corresponding author



HARI KRISHNAN G

Department of Biomedical Engineering Sathyabama University, Chennai

I. INTRODUCTION

Mode, Variance and Max-Min were used for easy differentiation between normal and disease affected joint. The Infrared camera connected through Laptop via a firewire interface for capturing 14 bit thermal images at 30 frames speed per second duration¹. Using MATLAB array of temperature values for every pixel within the region of interest of IR image were processed for calculating Standard deviation, Skewness and the Kurtosis. Disease stages diagnosis using Matlab for finding threshold value of pixels of different stages and classify the stages according to the threshold value of each stage image². Psoriatic and Rheumatoid arthritis diagnosis using contrast enhanced MRI of wrist and hand MRI images with assistance of MATLAB software package for statistical analysis. The diagnosis process for Chronic, Systemic inflammatory disorder starts with the medical history of the patient followed by physical examination of physician and clinical test for finding out rheumatoid factor^{1,3&4}. Synovial tissue samples were taken from systemic inflamed Arthritis patients for examining histological features in context of anti circullinated protein antibodies⁵. In advanced stages of disorder diagnosis the patient has to undergo histopathological analysis of diseases which has been carried out in Laboratory^{6&7}. During the first stage of Chronic, Systemic inflammatory disorder the accumulation of amorphous, basic, proteinaceous material in the tissue matrix in vascular walls is present in the early stages Chronic, Systemic inflammatory disorder Skin nodules formation at slightly elevated lesions on or in the skin. Surrounding tissue

contains a homogeneous, eosinophilic, relatively acellular refractile substance with some of the staining properties of fibrin material and a primarily mononuclear inflammatory cell infiltrate. The Vasculitis, Sural nerve is assumed as stage III and stage IV. In stage III there is a visibility of the nerve bundle with the vasa nervorum in the center. In stage IV there is a visibility a high-power magnification of the artery reveals a necrotizing vasculitis. The lumen is completely occluded, and an inflammatory cell infiltrate can be seen.

II. MATERIALS AND METHODS

The proposed system executes Entropy calculation, KurtosisCalc, LowestGrey, SkewCalc, STDCalc and VarianceCalc functions using MATLAB software. These parameters were calculated for all images of Rheumatoid arthritis and based on statistical parameters difference four stages of RA can be obtained. The stained biopsy image is given as input and as the first step the colour image was converted in to grey scale image. The entropy and highest grey of the greyscale values of the input image was calculated to measure the number of specific ways in which a system may be arranged, often taken to be a measure of disorder in image. The excess kurtosis of the greyscale values of the input image is calculated using KurtosisCalc tool. The executed output from Matlab software giving details of Kurtosis, Lowest grey, standard deviation and variance etc., is as shown in figure 1.

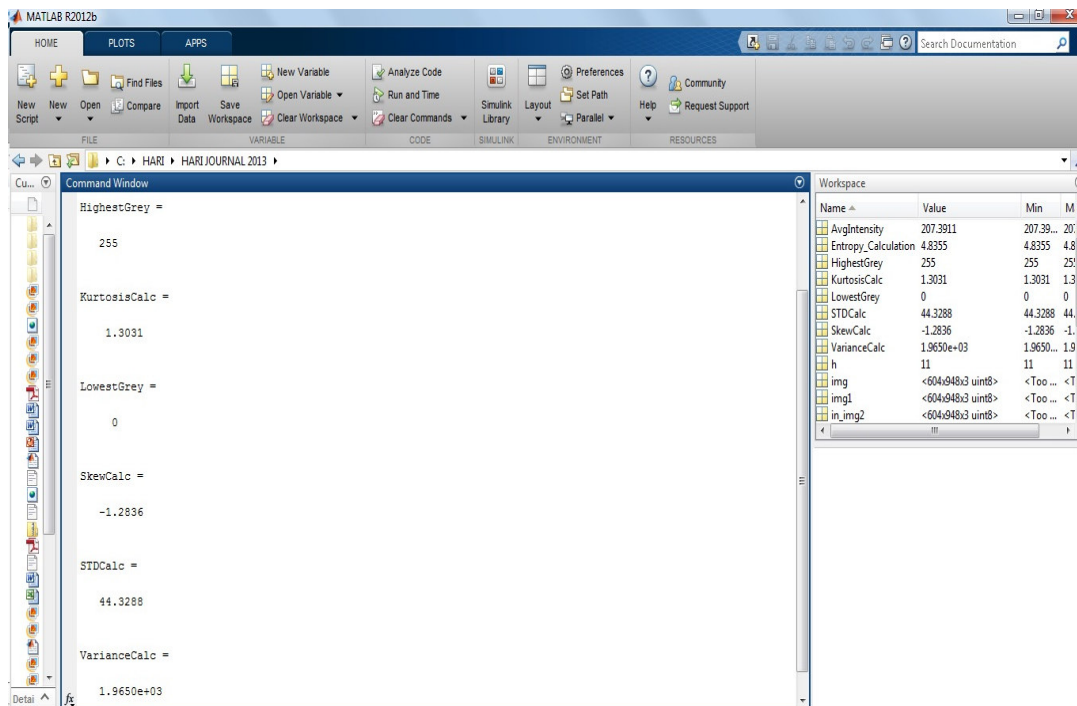


Figure 1
Matlab executed output window showing the different parameter values

Out of different parameters four parameters shown deviation from stage to stage this was useful for classifying the stages. The values of Entropy, Kurtosis, Standard deviation and

variance are tabulated and range of values for different stages can be clearly seen as given in the table 1.

Table 1
Different parameter and its variation according to different stages

PARAMETERS	STAGE 1	STAGE 2	STAGE 3	STAGE 4
Entropy_Calculation	4.84	4.91	4.77	4.72
KurtosisCalc	1.30	-0.58	0.23	-0.19
STDCalc	44.33	33.37	29.95	28.52
VarianceCalc	1965.00	1113.80	896.95	813.53

The lowest grey value, skew of the grey scale value was calculated using functions Lowest Grey & SkewCalc. STDCalc function returns an image that has been equalised by examining values in a moving 3x3 window on the input image. Variance Calc function returns an image that has been equalised by examining values in a moving 5x5 window on the input image. The return values of Entropy calculation, Kurtosis Calc, Lowest Grey, Skew

Calc, STD Calc and Variance Calc functions were tabulated with separate table for each stage of disease. From the tabulated values it was observed that there is large variation between each stage with respect to Entropy, Standard deviation and Variance values. No change or small variation between each stage with respect to Lowest grey, Highest grey and Skew values.

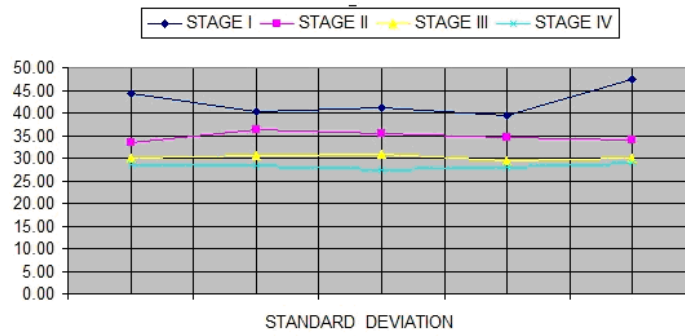


Figure 2
Standard Deviation Vs each Chronic, Systemic inflammatory Disorder stages with multiple images.

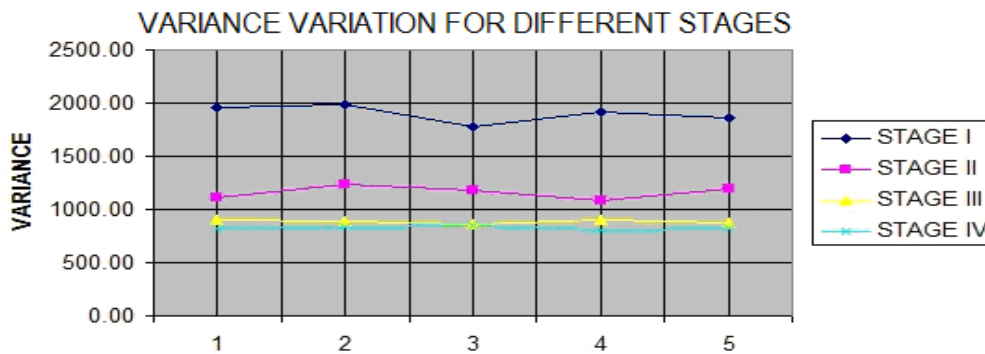


Figure 3
Variance Vs each Chronic, Systemic inflammatory disorder stages with multiple images.

III. RESULTS AND DISCUSSION

Based on the tabulated values four graph were plotted with first two graphs were Standard deviation Vs each Stages of Systemic inflammatory disorder and Variance Vs each stage with multiple images as shown

in figure [2 and 3]. The other two graphs were Standard deviation Vs each Stages of Rheumatoid arthritis and Variance Vs each stage with one image from each stage as shown in figure [4 and 5].

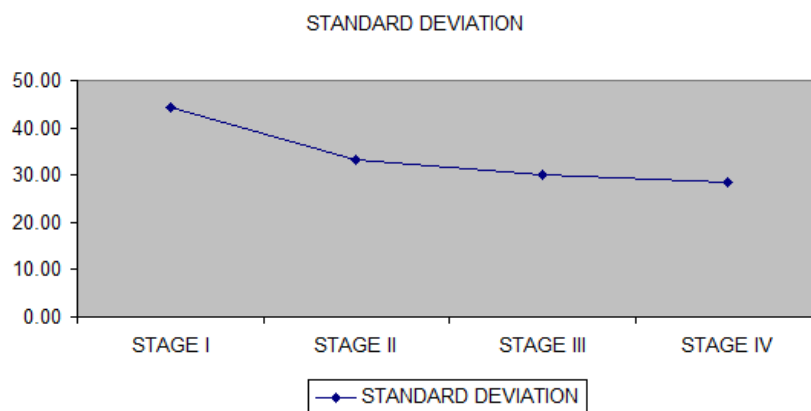


Figure 4
Standard Deviation Vs each Chronic, Systemic inflammatory disorder stages for single image.

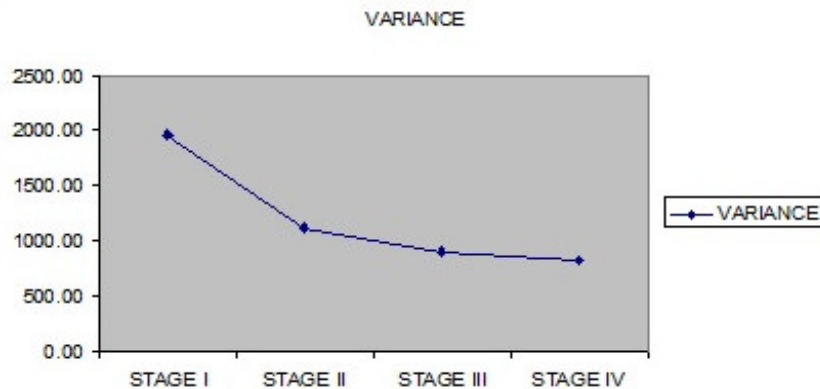


Figure 5
Standard Deviation Vs each Chronic, Systemic inflammatory disorder stages for single image.

IV. CONCLUSION

The Matlab software has been utilized with functions like Entropy Calculation, Highest Grey, Kurtosis calculation, Lowest Grey, Variance Calculation and STD calculation. The twenty biopsy images of different stages were diagnosed and categorized as Stage I,

Stage II, Stage III and Stage IV of Chronic, Systemic inflammatory disorder with the assistance of expertise pathological physician, an image processing tool has been developed using Matlab.

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