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A Quantitative Evaluation of Tuberculin Skin Using SVD

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ABSTRACT: Tuberculosis (TB) disease is a main global health threat. An estimated one-third of the world's population has been exposed to TB, and millions of new infections are occurring every year. Tuberculosis naturally affects the lungs it also affects the other parts of our body. Tuberculosis is currently the world's leading cause of death from a single infectious disease. In the case of an epidemic the only option of diagnosis remains is the sputum examination. Tuberculosis is most common contagious disease. Nowadays, millions of human beings of the world are suffering from it. To improve the diagnostic process we are developing an automated method for the detection of tuberculosis bacilli in clinical specimens, preferably sputum smears. The main constraints are expertise human, time and cost to implement our process. We will use Thresholding, multi-stage, SVD segmentation identified possible 'Tuberculosis objects', removed artifacts by shape comparison and color-labeled objects as 'definite', 'possible' or 'non-Tuberculosis', bypassing photomicrography calibration. In our work, we will use an algorithm based on image processing is developed for identification of Tuberculosis. The developed system , currently shows 93.5% sensitivity for identifying individual bacilli. There are numerous TB bacilli with active pulmonary TB in the patient's sputum. The overall diagnostic accuracy of the patients with positive smear is expected to be very high. Some potential benefits of automated screening for TB are accurate and rapid diagnosis, increased population screening and reduced health risk.

KEYWORDS: Segmentation, SVD, Features, Image Processing

I. INTRODUCTION

One way of detecting tuberculosis is through the use of tuberculin skin test, which is being used globally by health institutions for many years now. The test involves injecting a purified protein derivative to the patient's arm that will cause a small wheal to that area (see Figure 1) [1]. After 48-72 hours, the wheal will be measured using a millimetre ruler which is the standard procedure of the test. The size of the wheal is one determinant whether the patient has a prior TBexposure or not. The wheal, produced by tuberculin skin tests, was identified by nurses through marking its edges. Four marks will be made and these will be measured – the greatest length of each mark to another mark is considered the size of the wheal. An attempt to imitate the procedure was done by designing a system that can measure the marked sides of the wheal. The implemented system uses an algorithm which locates the four marks in an image. These four marks were measured using the Euclidean distance to determine the distance between each other. The results showed that the system's measurement is always less than the measurement of the nurse. With an accuracy of 91.53% for the test data, the researcher was able to implement a system that can facilitate in reading the results of tuberculin skin test.

II. RELATED WORK

Tuberculosis (TB) is a longstanding infectious disease and a major public health issue. TB has caused by Mycobacterium tuberculosis (M. tuberculosis) that is airborne. It spreads through the air from an infected person to susceptible ones. The risk of becoming infected depends principally on how long and how intense the exposure to the bacterium is. Our approach is to develop the algorithm that will automatically detect the TB viruses. One third of the

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world's population has infected with TB [3]. New infections occur in about 1% of the population each year [3]. In 2014, 9.6 million cases of active TB that resulted in 1.5 million deaths. More than 95% of deaths occurred in developing countries. The number of new cases each year has decreased since 2000 [3]. About 80% of people in many Asian and African countries test positive while 5–10% of people in the United States population tests positive by the tuberculin test [3]. Tuberculosis has been present in humans since ancient times [3].
Tuberculosis control efforts hampered by a mismatch in diagnostic technology: modern optimal diagnostic tests are least available in poor areas. Lack of adequate early diagnostics and MDR detection is a critical problem in control efforts. Our intention is to make the process easier for rural area people [4].

Toward Non-Invasive and Automatic Intravenous Infiltration Detection: Evaluation of Bioimpedance and Skin Strain in a Pig Model- A. OzanBicen ; Leanne L. West ; Liliana Cesar ; Omer T. Inan

Intravenous (IV) therapy is prevalent in hospital settings, where fluids are typically delivered with an IV into a peripheral vein of the patient. IV infiltration is the inadvertent delivery of fluids into the extravascular space rather than into the vein (and requires urgent treatment to avoid scarring and severe tissue damage), for which medical staff currently needs to check patients periodically. In this paper, the performance of two non-invasive sensing modalities, electrical bioimpedance (EBI), and skin strain sensing, for the automatic detection of IV infiltration was investigated in an animal model.

A Data-Rich Longitudinal Wellness Study for the Digital Age: Fixing a Broken Medical System Requires Data About Each Patient -Gustavo Glusman

We live in an age of plentiful information, collected continuously by pervasive gadgetry, distributed through digital and social networks, and mined deeply by ever-more-powerful analytics systems. And yet, one of the things we know the least about is our bodies. When it comes to our own health, we are driving blindly. Modern medicine has clearly been remarkably successful, as evidenced by continually

A Spatial-Temporal Method to Detect Global Influenza Epidemics Using Heterogeneous Data Collected from the Internet- Xichuan Zhou ; Fan Yang ; YujieFeng ; Qin Li ; Fang Tang ; Shengdong Hu ; Zhi Lin ; Lei Zhang

This paper presents a spatial-temporal method that incorporates heterogeneous data collected from the Internet to detect influenza epidemics in real time. Specifically, the influenza morbidity data, the influenza-related Google query data and news data, and the international air transportation data are integrated in a multivariate hidden Markov model, which is designed to describe the intrinsic temporal-geographical correlation of influenza transmission for surveillance purpose

Analysis and classification of human skin diseases-P. B. Manoorkar ; D. K. Kamat ; P. M. Patil

The basic means of detecting these skin diseases is through visual inspection followed by biopsy and pathological examination. If the physician finds the appearance of lesion doubtful then normally visual inspection method is used for diagnosis but all malignant lesions are not identified through visual inspection. Now, there are no generally accepted tools that physician can use to immediately find the skin disease in the clinic. The studies have shown differences in the electrical impedance of the skin as a result of irritation, allergic reaction, location, sex, age and hydration.

Non-invasive, multi-modal sensing of skin stretch and bioimpedance for detecting infiltration during intravenous therapy- Jambu A. Jambulingam ; Russell McCrory ; Leanne West ; Omer T. Inan

This paper proposes a novel proof-of-concept system that uses non-invasive sensing in conjunction with a low-power embedded computing platform to deliver continuous infiltration monitoring around the IV catheter site. This kind of system could be able to detect an infiltration by non-invasively monitoring for known symptoms: swelling of soft tissue and increased skin firmness; these symptoms can be sensed by measuring skin stretch and local bioimpedance.

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Moreover, the low-power design and wireless capabilities can potentially enable continuous wear. The proposed automatic IV infiltration detection system could significantly improve the number of infiltrations identified and treated on time.

Automated in vivo 3D high-definition optical coherence tomography skin analysis system- Ai Ping Yow ; Jun Cheng ; Annan Li ; RuchirSrivastava ; Jiang Liu ; Damon Wing Kee Wong ; Hong Liang Tey

The in vivo assessment and visualization of skin structures can be performed through the use of high resolution optical coherence tomography imaging, also known as HD-OCT. However, the manual assessment of such images can be exhaustive and time consuming. In this paper, we present an analysis system to automatically identify and quantify the skin characteristics such as the topography of the surface of the skin and thickness of the epidermis in HD-OCT images. Comparison of this system with manual clinical measurements demonstrated its potential for automatic objective skin analysis and diseases diagnosis. To our knowledge, this is the first report of an automated system to process and analyse HD-OCT skin images.The experimentation is performed upon 200 guava samples. The fuzzy system is trained upon 60% of the dataset, yielding 93.4% classification accuracy.

III. PROPOSED ALGORITHM

The problem with the current system or procedure that nurses and medical practitioners use in that after making four marks of the edges of the wheal, they only measure the horizontal and vertical edges. In computer science, digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing.It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

A new method for reconstruction a shape of skin surface replica from shadingimage sequence taken with different light source directions. Since the shading images include shadowscaused by surface height fluctuation and specularand inter reflections, the conventional photometricstereo method is not suitable for reconstructing its surface accurately. In the proposed method, wechoose intensity data which do not include specularand inter reflections and self-shadows so that we cancalculate accurate normal vector from the selectedintensity data using SVD (Singular Value Decomposition) method

Restrict our description to gray scale images although generalization to color images is possible. A common approach used for color images is to separate the luminance information (luminance channel Y) from the color information (two chrominance channels U and V), and use the luminance layer only.Every gray scale image can be considered to be a matrix with an integer number corresponding to each pixel. If the SVD is applied to the full images, we obtain a global measure whereas if a smaller block (e.g., 8x8) is used, we compute the local error in that block. An alternative for the global measure is to obtain the local errors in smaller blocks, and average them in a certain way.Observed that the performance of M-SVD is considerably more consistent across distortion types and across distortion levels. The difference is more pronounced represents an extremely challenging measurement problem.

For removing those low intensity data from theprocess of fitting to sine curve, we take simplethresholding method, in which the intensity datalower than threshold are removed. The thresholdis determined with initial experiment. By the initialexperiment, we decide the threshold is 40, that isshown by the thick horizontal line.The reason that the intensity data do not havelower value is mostly caused by the inter reflection.The inter reflection gives some intensity in additionto the direct reflection of the light source.

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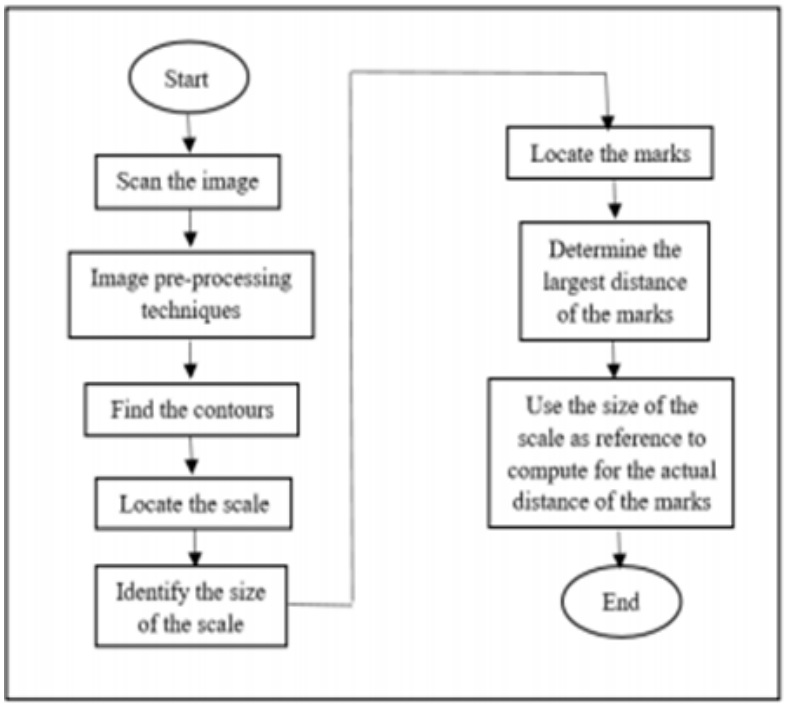
Algorithm;

Step 1: Reading in the data/Image

Step 2: Performing SVD

Step 3: Performing the cluster analysis

Step 4: Storing the results



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IV. RESULTS AND DISCUSSIONS

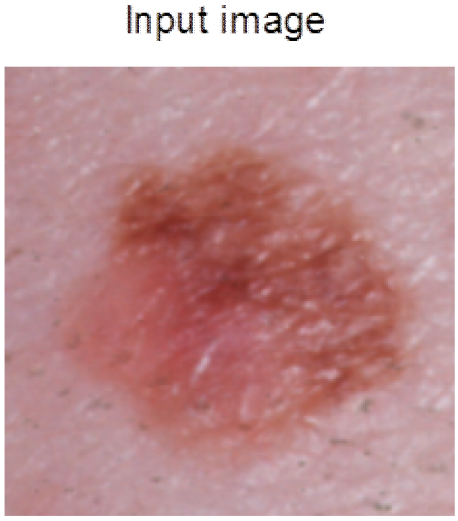

Figure 4.1 is an Original TB Skin Image obtained from Datasets

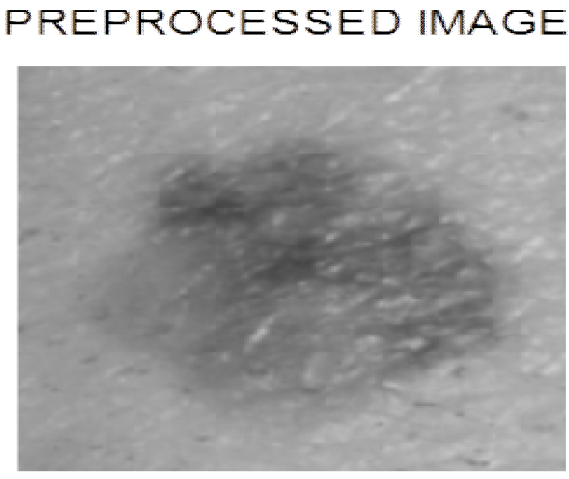

Fig 4.2 shows an gray scale image.

The original RGB image is converted to black and white image (Gray scale image). I=rgb2gray(RGB) which converts the color image RGB to grayscale intensity image I by eliminating the hue and saturation information while retaining the luminance. Gray levels represent the interval number of quantization in gray scale image processing. At present, the most commonly used storage method is 8-bit storage. There are 256 gray levels in an 8 bit gray scale image, and the intensity of each pixel can have from 0 to 255, with 0 being black and 255 being white.

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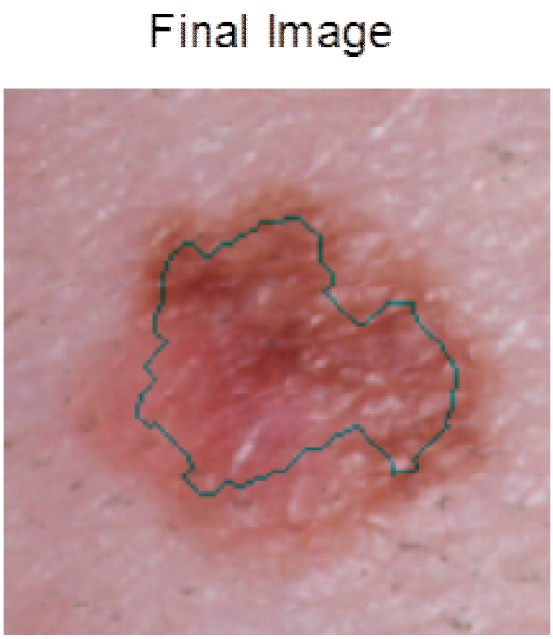

Figure 4.3 Final Segmented image

Image segmentation is the process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in digital images.Image thresholding is a simple, yet effective, way of partitioning an image into a foreground and background. This image analysis technique is a type of image segmentation that isolates objects by converting grayscale images into binary images. Image thresholding is most effective in images with high levels of contrast.

```
Roundness =

     1.405760079527199e-01


Diameter =

     8.535500380747810e+01

TB DETECTED
```

Feature extraction a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval.

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V. CONCLUSION AND FUTURE WORK

In machine learning, pattern recognition and in image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is a dimensionality reduction process, where an initial set of raw variables is reduced to more manageable groups (features) for processing, while still accurately and completely describing the original data set.The method can also be used to retrieve atmospheric variables from satellite measurements; it can be used to interpolate sparse measurements; and it can be used directly as a machine learning technique both for classification and regression as well as many, many other things

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