A Review: Classification Of Bacterial Microscopic Images Using Artificial Neural Network Approach

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Abstract : Manual bacteria classification is a tedious work which often needs abundant correlative data and also takes a great deal of time and energy. Combining pattern recognition and new neural network, we propose an approach of bacteria classification based on artificial neural network. The neural network is applied to extract the feature. Automatic detection of Bacteria is an essential research topic as it may be advantageous in monitoring huge fields of Bacteria, and detect the many type of bacteria as soon as they appear. Therefore the need for fast, automatic, less expensive and accurate method to detect Bacteria is of great realistic significance. In this Purposed work extraction of Bacteria microscopic images, feature extraction, classification of bacteria microscopic images. The main aim of the method is to develop a Computer Aided system for classification of bacteria different-different types.

IndexTerms - MatLab, Nuero Solution Software, Microsoft excel, Various Transform Technique.

I. INTRODUCTION

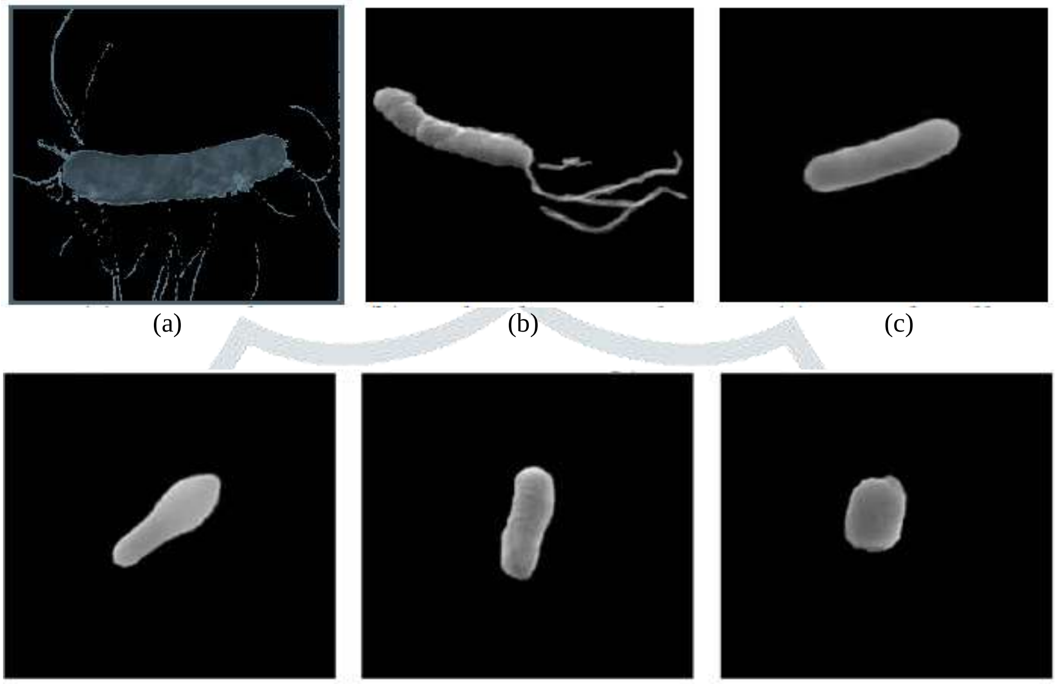
The simplest organisms living on earth today are bacteria, and biologists think they closely resemble the first organisms to evolve on earth. Too small to see with the unaided eye, bacteria are the most abundant of all organisms and are the only ones characterized by prokaryotic cellular organization. Life on earth could not exist without bacteria because bacteria make possible many of the essential functions of ecosystems, including the capture of nitrogen from the atmosphere, decomposition of organic matter, and, in many aquatic communities, photosynthesis. Indeed, bacterial photosynthesis is thought to have been the source for much of the oxygen in the earth's atmosphere. Bacterial research continues to provide extraordinary insights into genetics, ecology, and disease. An understanding of bacteria is thus essential.

Bacteria are the oldest, structurally simplest, and the most abundant forms of life on earth. They are also the only organisms with prokaryotic cellular organization. Represented in the oldest rocks from which fossils have been obtained, 3.5 to 3.8 billion years old, bacteria were abundant for over 2 billion years before eukaryotes appeared in the world. Early photosynthetic bacteria (cyanobacteria) altered the earth's atmosphere with the production of oxygen which lead to extreme bacterial and eukaryotic diversity. Bacteria play a vital role both in productivity and in cycling the substances essential to all other life-forms. Bacteria are the only organisms capable of fixing atmospheric nitrogen. About 5000 different kinds of bacteria are currently recognized, but there are doubtless many thousands more awaiting proper identification. Every place microbiologists look, new species are being discovered, in some cases altering the way we think about bacteria. In the 1970s and 80s a new type of bacterium was analyzed that eventually lead to the classification of a new prokaryotic cell type, the archeabacteria (or Archaea). Even when viewed with an electron microscope, the structural differences between different bacteria are minor compared to other groups of organisms. Because the structural differences are so slight, bacteria are classified based primarily upon their metabolic and genetic characteristics. Bacteria can be characterized properly only when they are grown on a defined medium because the characteristics of these organisms often change, depending on their growth conditions. Bacteria are ubiquitous on Earth, and live everywhere eukaryotes do. Many of the other more extreme environments in which bacteria are found would be lethal to any other form of life. Bacteria live in hot springs that would cook other organisms, hypersaline environments that would dehydrate other cells, and in atmospheres rich in toxic gases like methane or hydrogen sulfide that would kill most other organisms. These harsh environments may be similar to the conditions present on the early Earth, when life first began. It is likely that bacteria evolved to dwell in these harsh conditions early on and have retained the ability to exploit these areas as the rest of the atmosphere has changed.

1.1 Bacterial Form

Bacteria are mostly simple in form and exhibit one of three basic structures: bacillus (plural, bacilli) straight and rod shaped, coccus (plural, cocci) spherical-shaped, and spirillus (plural, spirilla) long and helical-shaped, also called spirochetes. Spirally bacteria generally do not form associations with other cells and swim singly through their environments. They have a complex structure within their cell membranes that allow them to spin their corkscrew-shaped bodies which propels them along. Some rod-shaped and spherical bacteria form colonies, adhering end-to-end after they have divided, forming chains (see figure 34.2). Some bacterial colonies change into stalked structures, grow long, branched filaments, or form erect structures that release spores, single-celled bodies that grow into new bacterial individuals. Some filamentous bacteria are capable of gliding motion, often combined with rotation around a longitudinal axis. Biologists have not yet determined the mechanism by which they move.

In fact, manual bacteria classification is a complicated work, which not only needs abundant correlative data but also takes a great deal of time and energy. Classifying bacteria based on their morph metrics is one of the most useful methods. Studies have shown that different kinds of bacteria have different morph metrics. It means, for each kind of bacteria, its morph metrics have a relatively stable and unique form in the proper condition. That is a very important characteristic for automatic classification. In this purposed work, we try to classify Six type of Bacteria are as follow.



(a) (b) (c)

(d) (e) (f)

Figure 1: six type of bacteria(a) Peritricha(b) Helicobacter pylori (c) Lactobacillus d) Bacillus sphenoides (e) Salmonella (f) Globular bacillus

II. Literature Review

In the 1950s, Peter Sneath (England) was working on bacteria classification systems using computers [1]. Sokal and Sneath teamed up in 1963 to produce Principles of Numerical Taxonomy [2]. Later, Sneath and Sokal wrote Numerical Taxonomy: The Principles and Practice of Numerical Classification [3]. It became a standard work and started a bandwagon rush by taxonomists to employ these methods in classification. The utility of numerical taxonomy has been demonstrated in a number of studies [4-8]. We would like to discuss this point here to emphasize that numerical taxonomic methods present a very powerful multiple instrument. However, in the paper we will propose a new numerical method of bacteria classification based on morphometrics.

In fact, manual bacteria classification is a complicated work, which not only needs abundant correlative data but also takes a great deal of time and energy. Classifying bacteria based on their morphometrics is one of the most useful methods. Studies have shown that different kinds of bacteria have different morphometrics. It means, for each kind of bacteria, its morphometrics have a relatively stable and unique form in the proper condition. That is a very important characteristic for automatic classification. It is a pity that until now we have not discovered any research on bacteria classification with this property. In this paper, we try to deal with this problem. Pulse coupled neural network (PCNN) is a biologically inspired artificial neural network based on the work by Eckhorn et al [9]. Pioneering work in the implementation of the algorithms was done by Johnson and his colleagues [10, 11]. PCNN receives the input stimulus through both feeding and inhibitory linking connections. Then, the input signals are passed to an internal activation system, which accumulates the signals until it exceeds a dynamic threshold. The outputs of the internal activation system cause the threshold changing as well as the changing of the linking and feeding neurons states dynamically. PCNN was suitable for image processing [12] and applied widely in the field of object detection [13], image segmentation [14-17], and pattern recognition [18-20], etc.

III. RESEARCH METHODOLOGY

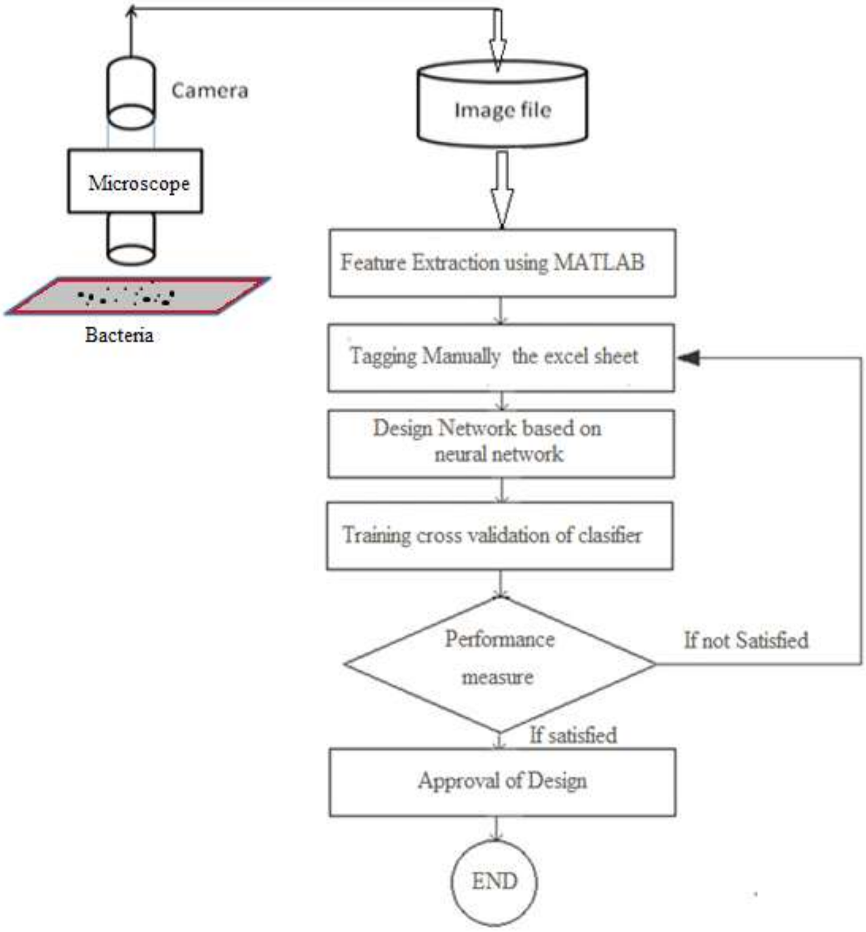


Figure 2:Flow chart

It is proposed to study the classification of six type of bacteria SEM images Using Neural Network Approaches.. Data acquisition for the proposed classifier designed for the Recognition of six type of bacteria images. Image data will be Collected from the different- different labs .The most important un correlated features as well as coefficient from the images will be extracted .In order to extract features, statistical techniques, image processing techniques, transformed domain will be used.

Computational Intelligence techniques include the following will established techniques.
i) Statistics
ii) Image processing
iii) Learning Machines such as neural network .
iv) Transformed domain techniques such as FFT, DCT, WHT, HISTOGRAM etc.

For choice of suitable classifier following configuration will be investigated.
i) Multilayer perceptron Neural network.
ii) Radial Basis function Neural network.
iii) Generalized Feed Forward Neural Network

For each of the architecture, following parameters are verified until the best performance is obtained.
i) Train-CV-Test data
ii) Variable split ratios
iii) Retraining at least five times with different random initialization of the connection weights in every training run.
iv) Possibility different learning algorithms such as Standard Back-Propagation, Conjugate gradient algorithm , Quick propagation algorithm, Delta Bar Delta algorithm, Momentum.
v) Number of hidden layers
vi) Number of processing elements of neurons in each hidden layer.

After regions training & retraining of the classifier, it is cross validated & tested on the basis of the following performance matrix.
i) Mean Square Error
ii) Normalized Mean Square Error
iii) Classification accuracy
iv) Sensitivity
v) Specificity

In order to carry out the proposed research work, Platforms/Software's such as Matlab, Neuro solutions, Microsoft Excel will be used.

III.RESEARCH OBJECTIVES:

i)To maintain the correctness & accuracy in the classification of bacteria even though the input images are contaminated by known or unknown noise.
ii)To increase the classification accuracy for the six type of bacteria.

IV. CONCLUSION

This paper demonstrated how to using artificial neural networks(ANN)could be used to build accurate Six type of Bacteria image classifier and i am also try to achieved result more accurate and reliable.

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