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Identification of Bacteria using Machine Learning Algorithm

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Abstract: In the field of microbiology, there is no direct method to find out the microorganism and their species of bacteria. Microscopic sample analysis is a common manual technique employed for bacterial detection and identification. These tests will be less time-consuming and is subjected to more accuracy. Hence it requires highly trained personnel for testing. In order to overcome the existing manual problems, machine algorithms are used. The main aim of this project is to use image-processing techniques to identify the bacteria from images. Image processing is a technique to perform some manipulations or operations in an image, in order to get an improved image or to extract some useful information from it. At present, image processing is a rapidly growing technology. Using machine learning algorithms bacteria is identified with less time and more accuracy.

Keywords: Bacteria, Microorganism, Image Processing, Identification.

I. INTRODUCTION

Bacteria are identified routinely by morphological and biochemical tests, supplemented as needed by specialized tests such as serotyping and antibiotic inhibition patterns. Newer molecular techniques permit species to be identified by their genetic sequences, sometimes directly from the clinical specimen. In microbial ecology, the identification of microorganisms helps us characterize biodiversity. Because the clinical samples will most likely contain many microorganisms, both normal flora and pathogens, it is important to isolate the pathogen in a pure culture using various types of selective and differential media. Bacteria are a very small organism and they cannot be visible by human eyes. To visualize them, electron microscope is used. The most important task in microbiology is to identify the bacteria from the culture plate. To prepare a culture plate, the separation of a dilute mixed population of microorganisms is done by using the spread plate technique.

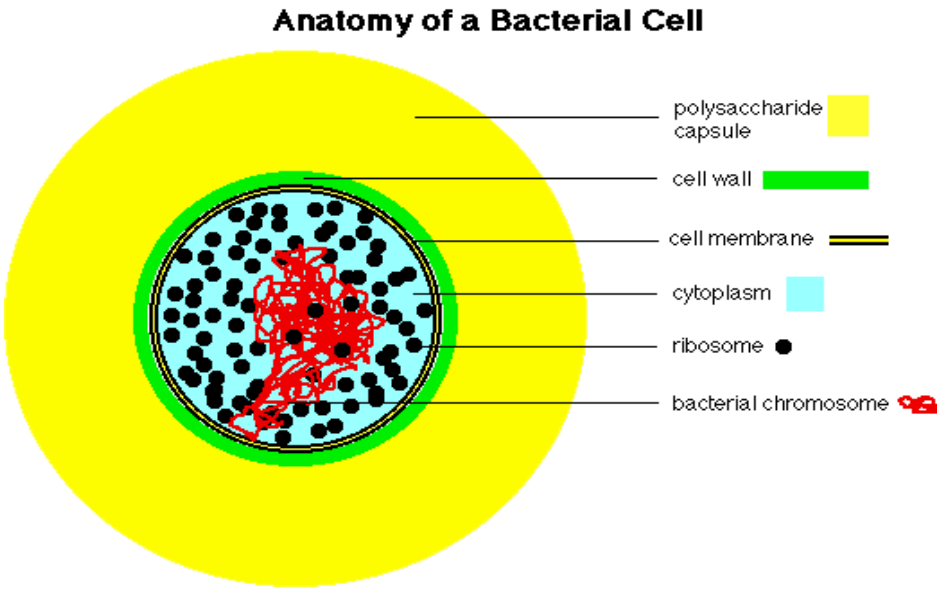

Fig 1. Anatomy of a bacterial cell

Machine learning is a field of computer science that uses statistical techniques to give computer systems the ability to "learn" (e.g., progressively improve performance on a specific task) with data, without being explicitly programmed.

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Machine learning is closely related to computational statistics, which also focuses on prediction-making through the use of computers. It has strong ties to mathematical optimization, which delivers methods, theory and application domains to the field. Machine learning is sometimes conflated with data mining, where the latter subfield focuses more on exploratory data analysis and is known as unsupervised learning. Machine learning can also be unsupervised and be used to learn and establish baseline behavioral profiles for various entities and then used to find meaningful anomalies. Within the field of data analytics, machine learning is a method used to devise complex models and algorithms that lend themselves to prediction; in commercial use, this is known as predictive analytics. These analytical models allow researchers, data scientists, engineers, and analysts to "produce reliable, repeatable decisions and results" and uncover "hidden insights" through learning from historical relationships and trends in the data. Effective machine learning is difficult because finding patterns is hard and often not enough training data are available, as a result, machine-learning programs often fail to deliver.

II. EXISTING SYSTEM

Image processing is a technique to perform some manipulations or operations in an image, in order to get an improved image or to extract some useful information from it. At present, image processing is a rapidly growing technology. In the existing system basic neural network algorithm was used it is time consuming and more amount of data required to identify the bacteria and viruses.

III. PROPOSED SYSTEM

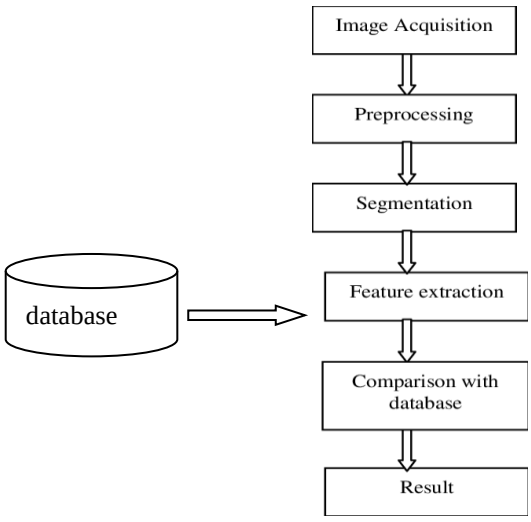
In this proposed system of bacterial identification MIA is Micro-Organism Identification Algorithm. This algorithm is used to identify a single unit cell from a picture containing too many bacteria or viruses. So, we are using this algorithm. This algorithm uses a specialised clipping and cropping for the identification of bacteria and viruses. In the base paper they are using only bacteria. But we are using both bacteria and viruses.

IV. MODULES

- Feature identification
- Feature extraction
- Feature classification

A. Architecture of the work

Image identification is the process of capturing image with the help of a digital camera attached with an electron microscope. After the identification process, the capturing image will have some unwanted noises for instance the image may contain some unwanted artifacts to the human eyes. These kinds of noise will be removed by applying a particular noise to the original image and this noisy image will be filtered using filtering techniques. For this filtering technique feature extraction are to be used. After removing unwanted features from the image feature is extracted from the image for the further processing. For this purpose, a segmentation technique should be used. Segmentation is the process of partitioning an image into multiple regions/parts. Through this the image will be easily analyzed. Here, Region Of Interest (ROI) technique is used for segmenting the image.



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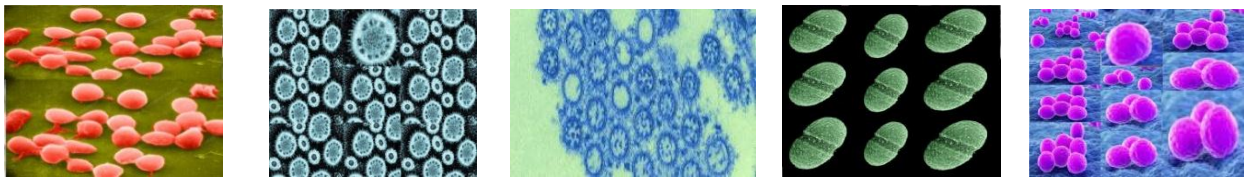
To remove small drops in the image, morphological techniques will be used. various features are extracted from the segmented region. In this work, the size of the segmented cell structure will be identified, which is known as feature extraction. After that, the result (size) will be compared with the database and the bacterium which satisfies the criteria (size) will be displayed as by its name.



micrococcus mers h1n1 Enterococcus staphylococcus

Fig. 3 Dataset

these images are then preprocessed to remove noise from the image. when a noise removal technique is applied, the existing noise (during the capturing time) will also be removed. here, the median filter technique will be applied to improve the quality of the image as shown in figure.4

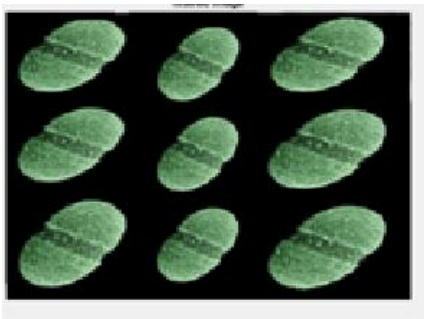


Fig.4 Preprocessing

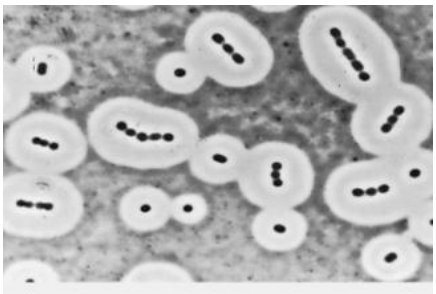


Fig.5 Filtered image

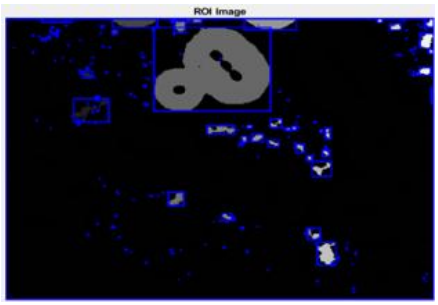


Fig.6 Roi

Using the ROI Segmentation technique a particular cell structure is segmented to identify the diameter of a bacterium. After this extraction, a threshold image will be obtained. Using the fill, open and clear border morphological operations the unwanted structures of the unwanted noise will be removed will contain the image which is to be used in feature extraction, to identify the size of the region selected region segmented in Region Of Interest (ROI) technique.

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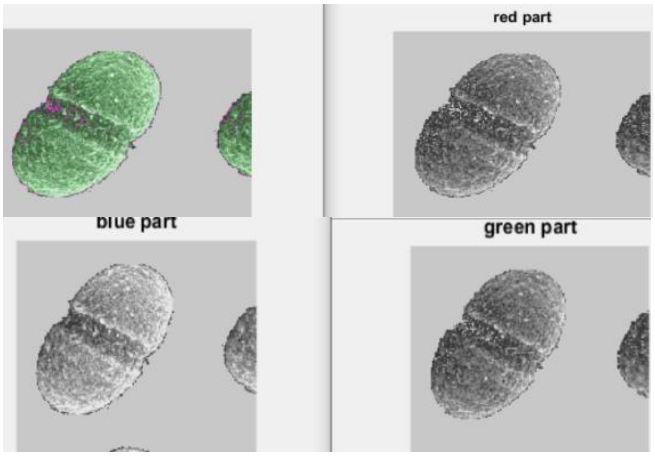

Fig.7 Resultant image

IV. RESULT

The diameter is compared with the database which contains bacteria name and their size. After that, the result will be fetched from the database if it matches with the resultant size. Finally, the name of the bacterium will be known in an easier way without much human work and human error. This work identifies coccus bacteria by its size represented in a database Using this work, the much manual work has been reduced to identify the bacteria and so the time and cost (include the cost of chemicals, trained personnel etc.,) used for the existing manual process will be reduced. The medical and the microbiology field are correlated together in this work.

V. CONCLUSION

Bacteria are a very small organism and they cannot be visible by human eyes. To visualize them, electron microscope is used. The samples contain microorganisms which are harmful to the human. To detect the particular microorganism, the medical domain uses the microbiology biochemical tests. Because of this work, the microbiology field should be enriched. This work is designed based on MIA algorithm to identify the bacteria and GLCM is used to extract the features and CNN is used for faster results and accuracy and it is used to identify the coccus bacteria in an easier and efficient manner with less manual work. this work will be for the other two kinds of bacteria (rod and spiral) to find out their species name based on the same parenthesis (size).

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