

Machine Learning-Based Anemia Prediction System and Deep Learning-Assisted Blood Cell Classification

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Abstract:

The Hematology Web Lab paper provides a scalable and efficient digital platform for medical diagnostics, with a focus on blood cell classification and anemia detection. The technology combines machine learning and deep learning techniques to evaluate clinical hematological data and produce accurate diagnostic predictions. Hemoglobin level, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) are some of the key hematological markers used to predict anemia. Several supervised machine learning techniques, such as Naïve Bayes, Random Forest, Decision Tree, K-Nearest Neighbors (KNN), Support Vector Machine (SVM), and Logistic Regression, are employed to provide reliable classification and robust performance over a range of datasets.

The platform includes a deep learning-based image classification algorithm that distinguishes between neutrophils and eosinophils in addition to tabular data analysis. The model's ability to automate microscopic blood cell examination is demonstrated by its 90% accuracy rate. This automated method improves diagnostic efficiency, lowers human error, and requires less manual intervention.

The MERN stack—MongoDB, Express, React, and Node.js—was used in the system's development to guarantee a scalable and responsive web application architecture. Flask APIs are coupled with backend services to provide smooth communication between predictive models and the front-end interface. Twilio and SMTP protocols are used to establish secure authentication techniques that preserve the privacy and confidentiality of data.



AWS EC2 provides dependable hosting and real-time inference capabilities, while AWS SageMaker is used for scalable model training and deployment. The successful fusion of cutting-edge artificial intelligence methods with contemporary online technology is demonstrated by the Hematology online Lab. The technology offers real-time blood cell categorization and anemia prediction, which enhances diagnostic assistance and marks a major breakthrough in digital healthcare solutions.

Keywords:

Anemia Detection, Blood Cell Classification, Machine Learning, Deep Learning, Hematological Parameters, Logistic Regression, Random Forest, Support Vector Machine, Naïve Bayes, MERN Stack, Flask API, AWS SageMaker, AWS EC2, Digital Health, Medical Diagnostics.