Predicting Monkeypox via Deep Learning-Driven Primary Morphology Analysis

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On July 23, 2022, the World Health Organization declared the global monkeypox outbreak a Public Health Emergency of International Concern. It is diagnosed through Polymerase Chain Reaction tests, but in cases where PCR tests are not available, accessible alternatives need to be available. In 2022, Harvard conducted a study researching the feasibility of computer aided detection. They developed the “Monkeypox Skin Lesion Dataset (MSLD),” consisting of 228 original skin lesion images of monkeypox, chickenpox, and measles which were augmented to a total of 3192, and achieved an accuracy high of 82.96% using transfer learning. After further augmentations, we preprocessed images into trainable data by reading images into numpy arrays, normalizing pixel ranges, and reformatting arrays and data types for compatibility. We trained a convolutional neural network on our dataset, using techniques such as dropout and L2 regularization to prevent overfitting and improve model accuracy. We evaluated our model using a stratified 5-fold cross validation set with 30% holdout. On the holdout data, the model demonstrated a consistently high accuracy, yielding a 86.67% mean accuracy, 0.97% standard deviation, 7% false negative rate, 0.93 recall, 0.84 precision, and 0.88 F1-score. We developed a prototype web application to host our model on a user-friendly UI. Our model provides a free, accessible system to predict monkeypox with minimal human intervention. Further developments can be made to improve accuracy of the model, which can be integrated into medical websites such as the World Health Organization for public exposure.

Awards Won:
NC State College of Engineering: Alternates (not read aloud)
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