Image-Based Disease Severity Algorithm

No quantitative or standard way to measure disease severity

The global market for deep learning architectures is expected to reach USD 60.5B by 2025, with over 63% of healthcare companies using machine learning. Deep learning models expedite and improve the efficiency of discovering and proving correlations in data analysis, especially in healthcare research. Currently, there is no quantitative or standard way to measure the severity of disease. As a result, physicians gauge severity by looking at a large quantity of clinical labels, demographic information, and features within images which requires a large investment in time on the part of the interpreter. This interpretation process may also have potential flaws due to different understandings of the nature of the severity distribution among physicians. Additionally, this can potentially lead to privacy issues regarding access to all this information in order to make an assessment on severity.

Innovative algorithm uses images to quantitatively estimate the severity of clinical conditions

Georgia Tech researchers have developed an innovative algorithm that uses images to estimate the severity of clinical conditions in a quantitative manner. This algorithm employs an automatic methodology, demonstrating its validity by detecting disease manifestations, or biomarkers, within the images. A neural network is trained on a control dataset to learn the feature distribution of healthy data. Once the network is trained, an anomaly detection algorithm is utilized to generate anomaly scores for the data of interest, which allows for the assessment of severity. Each piece of data is then given a severity score. To verify the usefulness of these severity scores, they are discretized and used as labels to train a model with a contrastive loss. Subsequently, this model, which has been trained on severity labels, is fine-tuned to perform the task of detecting biomarkers for specific structures of interest.

Summary Bullets

- The technology utilizes an image-based algorithm and automatic methodology to detect biomarkers in disease.
- It leverages a well-trained neural network on a dataset of healthy instances to learn the feature distribution of the healthy data.
- Anomaly detection algorithms generate anomaly scores based on properties of the neural network, providing a measure of severity by assessing how anomalous an instance appears compared to the healthy

distribution.

Solution Advantages

- **Standardization of Classification:** This algorithm provides a quantitative estimation of severity by analyzing biomarkers within images and ensures consistent and objective severity assessments across different cases and healthcare professionals.
- **Cost and Time Effective:** The algorithm utilizes existing data resources without the need for additional data collection, reducing costs associated with data acquisition as well as eliminating the need for extensive labeling or annotation of abnormal samples.
- **Improved Accuracy:** By considering multiple statistics, the algorithm provides a more holistic view of the severity, resulting in improved accuracy compared to relying on a single metric.

Potential Commercial Applications

- Medical Diagnostics
- Clinical Disease Detection
- X-Ray/OCT Interpretations
- Hospitals and Medical Device Manufacturers
- Insurance Assessment

Inventors

- Dr. Ghassan AlRegib
  Professor – Georgia Tech School of Electrical and Computer Engineering
- Kiran Kokilepersaud
  PhD Student - Georgia Tech College of Engineering
- Mohit Prabhushankar
  Graduate Student – Georgia Tech School of Electrical and Computer Engineering

IP Status

Patent application has been filed : US63/426489

Publications

, -

Images

Visit the Technology here:
Image-Based Disease Severity Algorithm