A Machine Learning Method for the Automatic Classification of Strokes

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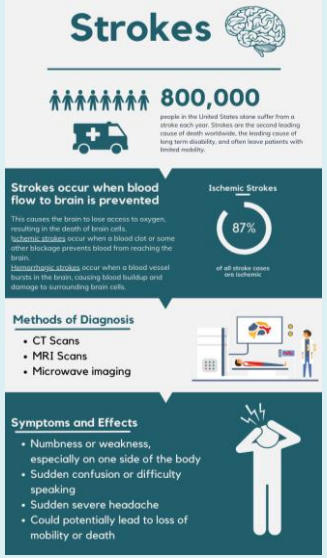
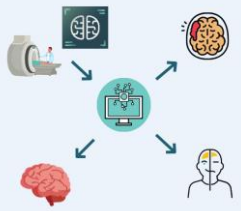
WPI

An Image Classification System Designed to Aid and Accelerate the Stroke Diagnosis and Detection Process

Background



Abstract



Materials

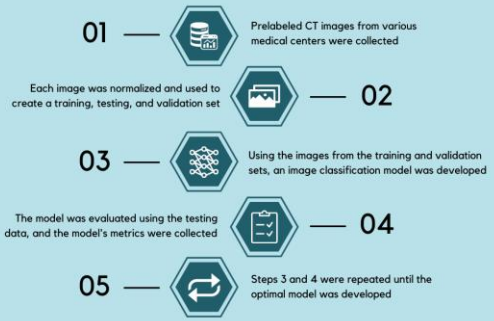
Problem Statement

Current stroke detection methods require too much time for the interpretation of scan results and classification process, delaying treatment and increasing the chance of lasting effects.

Engineering Objective

The objective of this project was to create a machine learning model to automatically detect and classify strokes using CT images in order to aid with the diagnostic process.

Methods

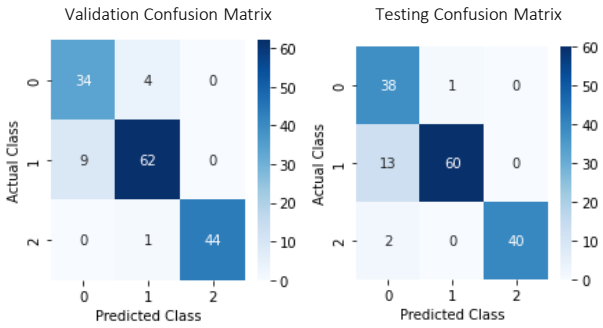


Design Matrix

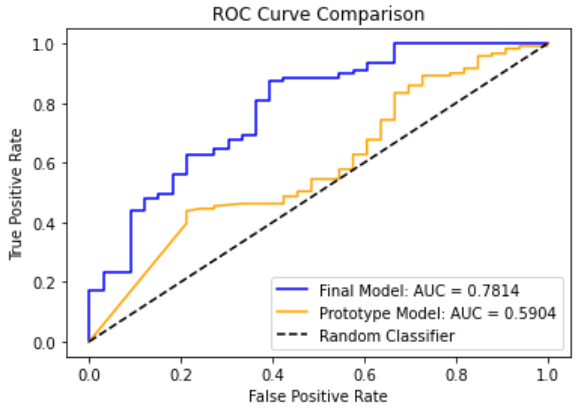
Evaluation of Common Classification Techniques in Image Classification

Criteria	Max	Decision Tree	SVM	KNN	CNN
Suitable with small datasets	6	3	5	2	4
High accuracy of output	10	6	8	7	8
High testing and training speed	9	6	8	4	8
Capable of dealing with large number of features	8	3	5	6	7
Easily improved and configured	7	3	5	5	6
Total	40	21	31	24	33
Percent	100%	53%	78%	60%	83%

Results



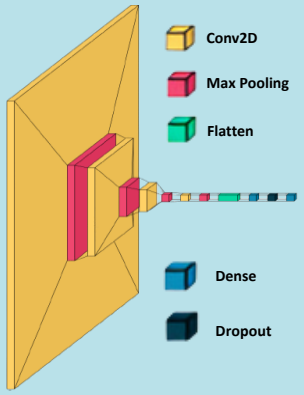
0 – Normal Scans | 1 – Hemorrhagic Strokes | 2 – Ischemic Strokes



Conclusions

- Final model classifies strokes with **89.6%** testing accuracy and **90.3%** validation accuracy
- Demonstrates the use of neural networks as a viable method of stroke classification
- Final model returns chance of abnormality from cranial CT scan
- Final model was a significant improvement over the first model, with a p-value of **0.0001**

Model Architecture



Extensions

- Testing on larger datasets
- Increasing classes to include other cranial diseases
- Testing during the real-time stroke diagnosis process
- Testing on other types of medical imaging (MRI or microwave imaging)

References

1. Chawla, M., Sharma, S., Sivaswamy, J., & Kishore, L. (2009). A method for automatic detection and classification of stroke from brain CT images. *2009 Annual International Conference of the IEEE Engineering in Medicine and Biology Society.* doi:10.1109/iembs.2009.5335289

2. Ireland, D., & Bialkowski, M. E. (2011). Microwave Head Imaging for Stroke Detection. *Progress In Electromagnetics Research M*, 21, 163-175. doi:10.2528/pierm11082907