INTRACRANIAL HEMORRHAGE TYPE CLASSIFIER

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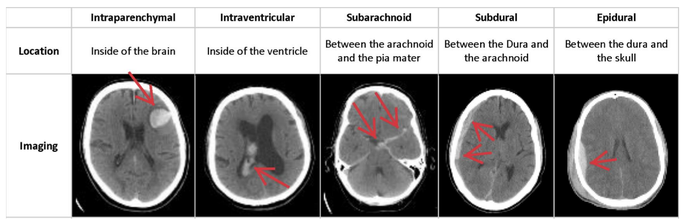
Abstract

Urgent diagnosis of intracranial hemorrhage type is necessary for improved chances of patient survival. We evaluate several 2D CNN models to perform both 5-class and 6-class multilabel classification of intracranial hemorrhages.

Dataset

Our dataset consists of 2D brain computed tomography (CT) images from Kaggle's RSNA Intracranial Hemorrhage that may or may not contain hemorrhages(s)

Intracranial Hemorrhage Types



The images were converted for easy input to our ML algorithm:
Dicom ➡ 224x224x3 images

Model and Results

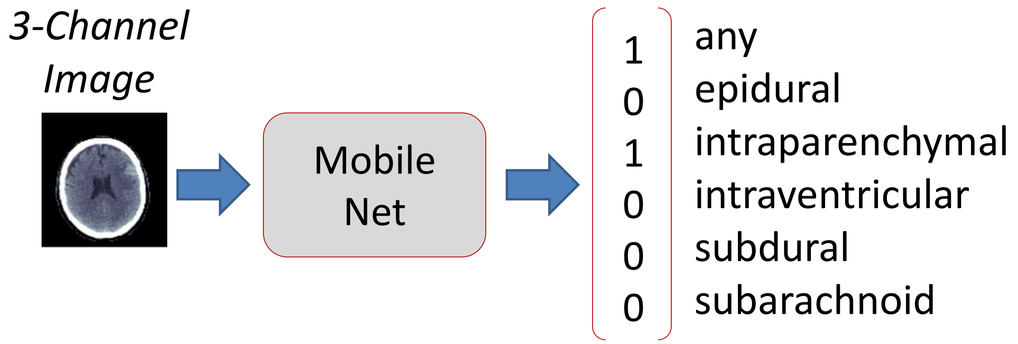


Table 1. Model Performance Comparison Using a 50-50 Split Hemorrhage Containing Dataset

	Baseline			Our Model			MobileNet		
	F1	Precision	Recall	F1	Precision	Recall	F1	Precision	Recall
Epidural	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Intraparenchymal	0.04	0.33	0.03	0.24	0.16	0.44	0.23	0.17	0.36
Intraventricular	0.05	0.11	0.03	0.20	0.14	0.38	0.08	0.06	0.15
Subarachnoid	0.02	0.24	0.22	0.27	0.18	0.57	0.25	0.18	0.44
Subdural	0.27	0.24	0.32	0.21	0.14	0.45	0.27	0.21	0.41
Any	0.46	0.46	0.46	0.61	0.53	0.73	0.65	0.50	0.93

Table 2. Model Performance Comparison Using a Solely Hemorrhage Containing Dataset

	Baseline			Our Model			MobileNet		
	F1	Precision	Recall	F1	Precision	Recall	F1	Precision	Recall
Epidural	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Intraparenchymal	0.30	0.28	0.33	0.26	0.21	0.35	0.41	0.29	0.70
Intraventricular	0.30	0.33	0.35	0.40	0.31	0.57	0.11	0.12	0.10
Subarachnoid	0.38	0.29	0.52	0.45	0.33	0.71	0.44	0.30	0.83
Subdural	0.42	0.60	0.32	0.60	0.47	0.80	0.64	0.49	0.91
Any	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Future Work

- 2D ➡ 3D CNN implementation to take advantage of depth information
- Incorporate additional preprocessing of images (thresholding, normalization) to help the model better identify hemorrhages
- Train on larger dataset to help with overfitting

Conclusions

Our 2D method is **simpler** than 3D methods, requiring **less time** and cost, making this technique suitable for **clinical applications**.

Highlights: MobileNet performance of **0.91** and **0.83** recall for subdural and subarachnoid hemorrhages, respectively

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