AUTOMATED CARDIAC DIAGNOSIS CHALLENGE (ACDC)

310657012 統研碩一 陳芃辰

Dataset

- Paper With Code

https://acdc.creatis.insa-lyon.fr/description/index.html

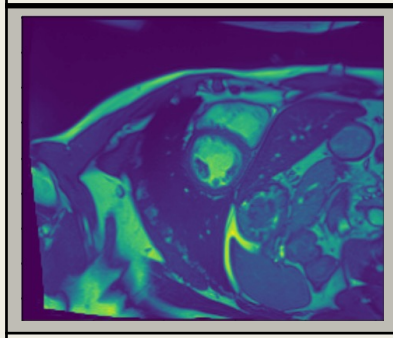
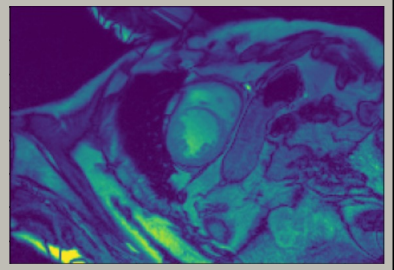
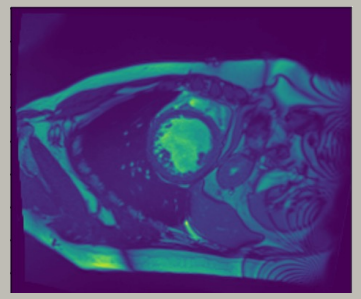
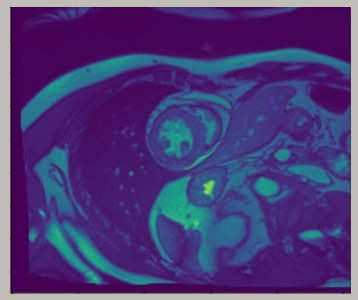
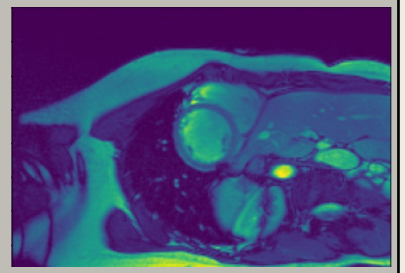
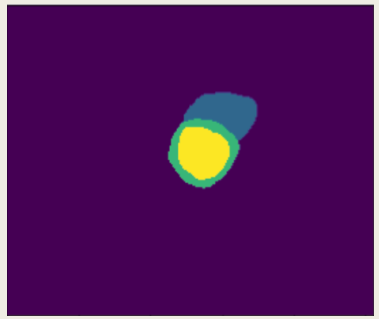
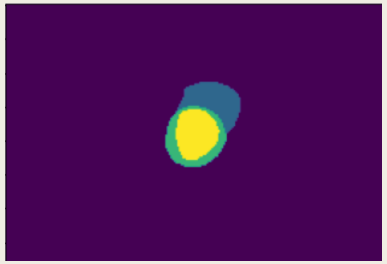
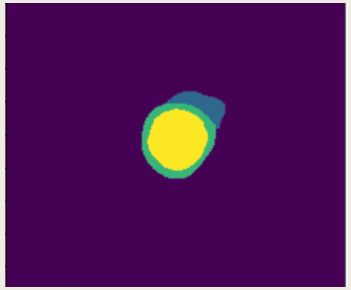
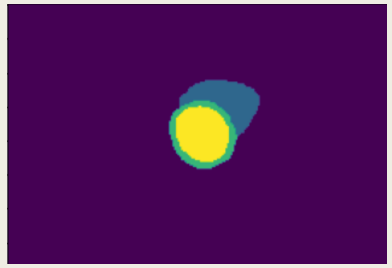
分辨心肌相關症狀

- 3D Cine MR Cardiac Image (NifTi file)
  - 3D ED Image（心室末期收縮）
  - 3D ES Image（心室末期舒張）
  - 3D Segmented ED Image（匡選心室末期收縮）
  - 3D Segmented ES Image（匡選心室末期舒張）

Classification (5 classes)

- Normal Patient (NOR)
- Previous Myocardial infraction (MINF) 先前的心肌梗塞
- Dilated Cardiomyopathy (DCM) 擴張性心肌病變
- Hypertrophic Cardiomyopathy (HCM) 阻塞性肥厚心肌症
- Abnormal Right Ventricle (RV) 不正常的右心室

Data Description

NOR-0	MINF-1	DCM-2	HCM-3	RV-4
				
				

Dataset

NOR	MINF	DCM	HCM	RV
20	20	20	20	20

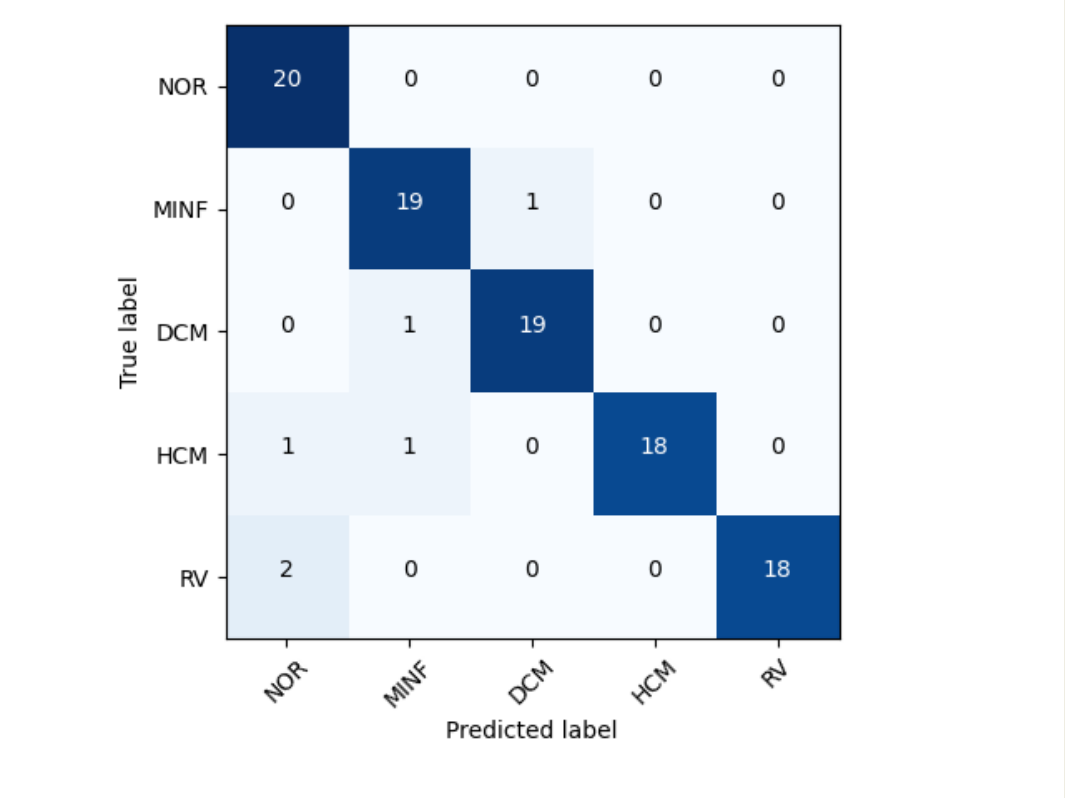
ML Classification

EDV_LV , EDV_RV , ESV_LV , ESV_RV ,

ED_MYO , ES_MYO , EF_LV , EF_RV , … … 總共20個變數

EF (ejection fraction) = stroke volume/end-diastolic volume

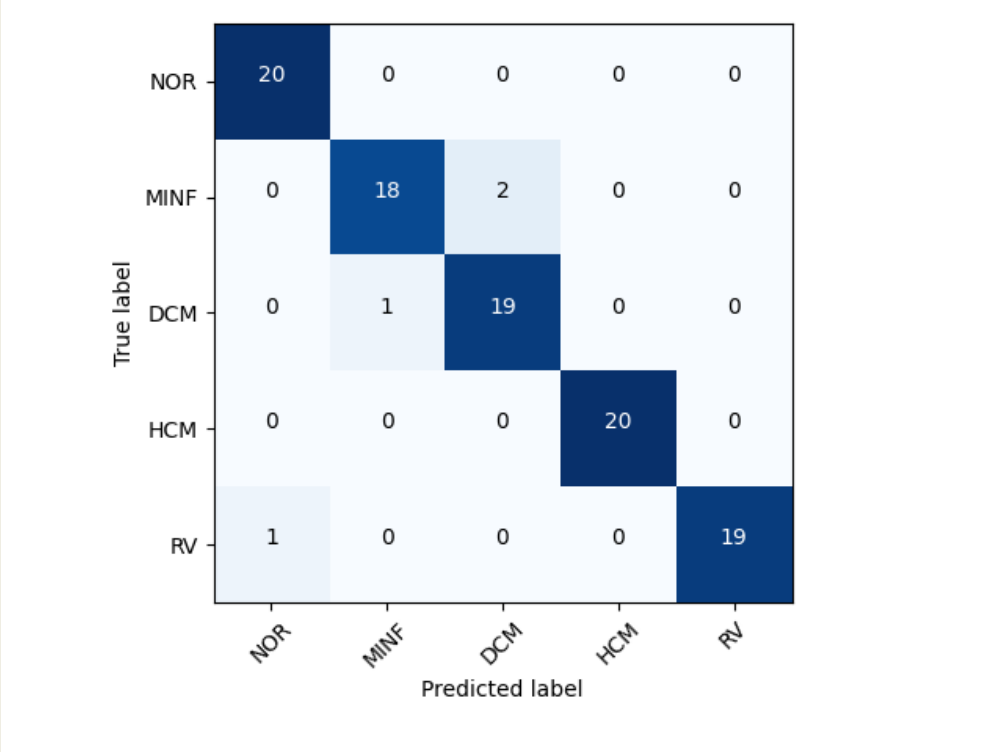
KNN Classification



[1. 0.9 0.95 0.95 0.9]

Accuracy: 0.94

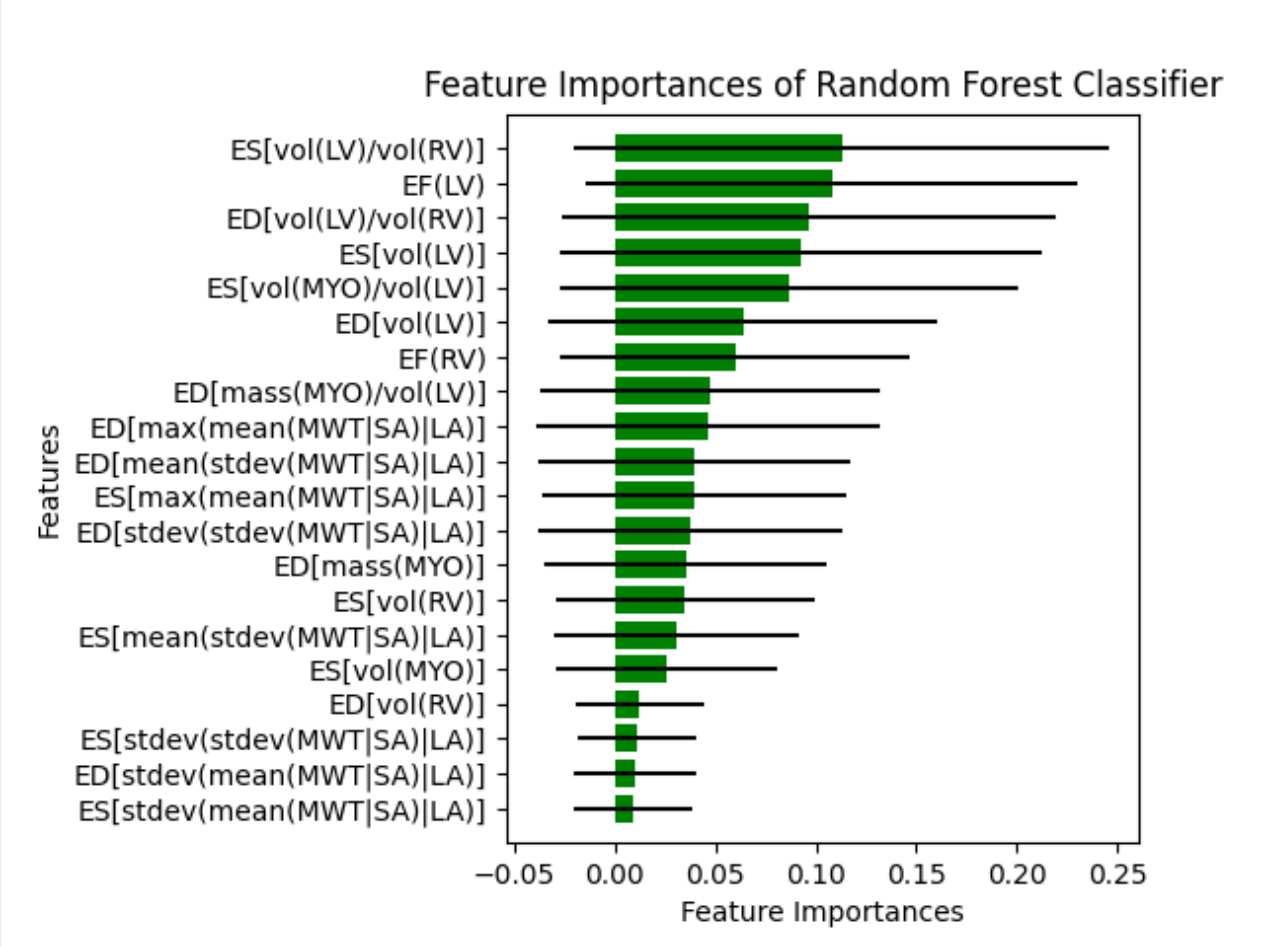
Random Forest Classification



[1. 0.9 1. 1. 0.95]

Accuracy: 0.97

Random Forest Features



DL 3D Classification

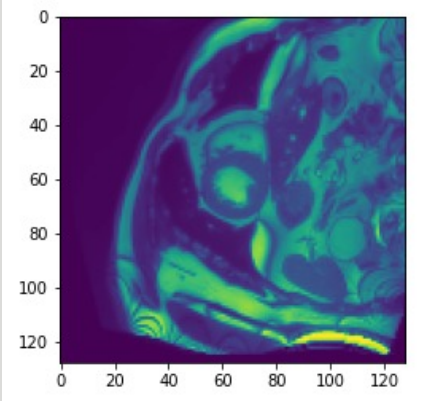
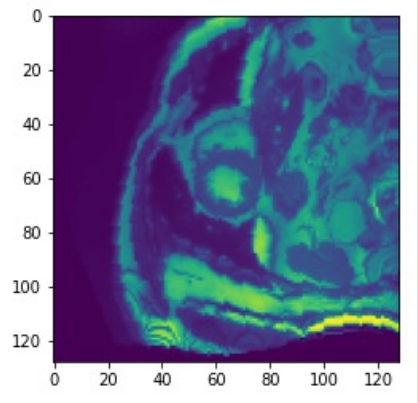
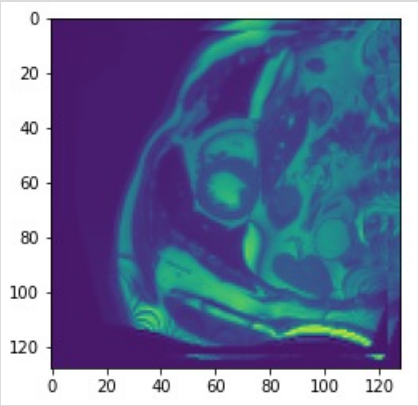
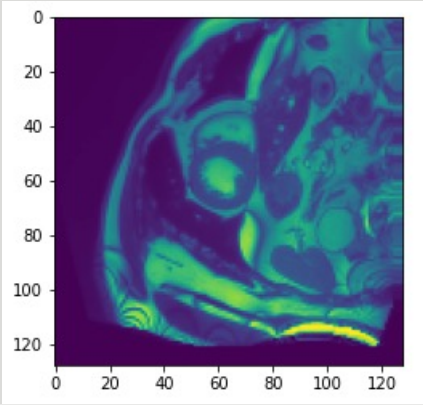
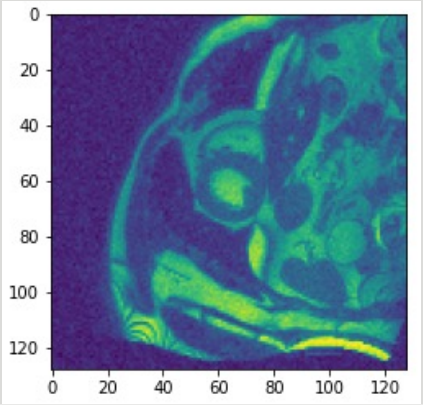
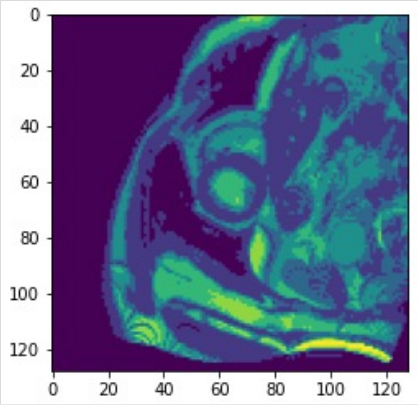
- Data Size: 128 x 128 x 8

Total Data	100
Train Data	70
Validation Data	15
Test Data	15

Data Augmentation

- Rotation (-10 , 10)
- Scale (0.9 , 1.1)
- Shift (-5 , 5)
- Gaussian Noise
- Contrast (alpha = (15, 30), beta = 20)

Data Augmentation

Original	Rotate	Scale
		
Shift	Gaussian	Contrast
		

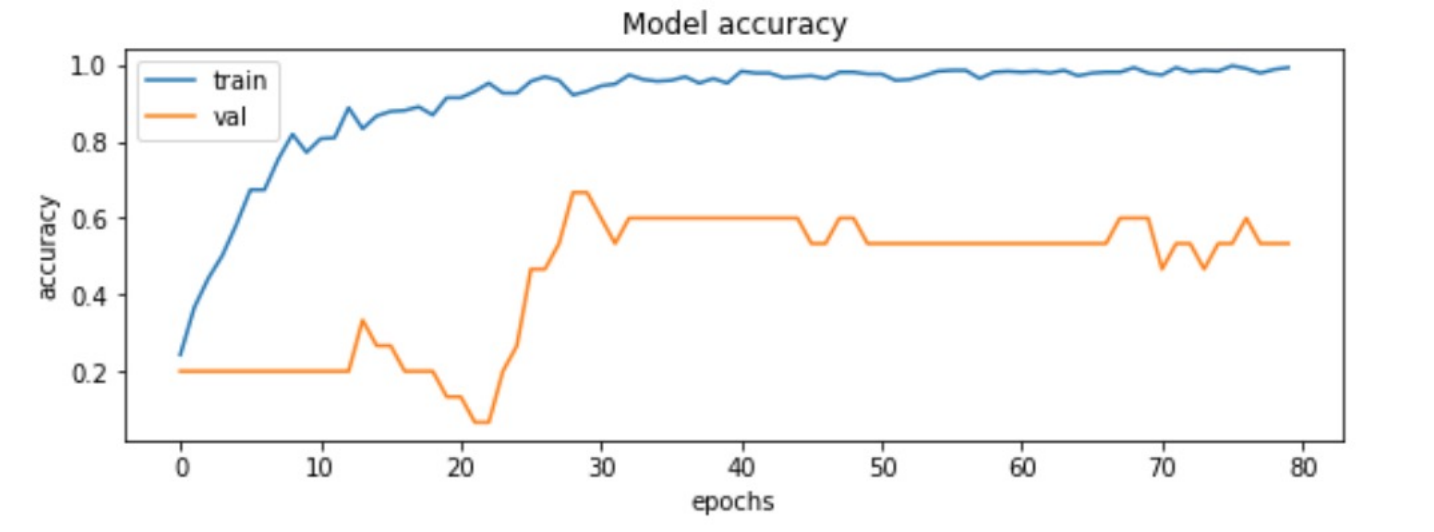
Model: Resnet 18

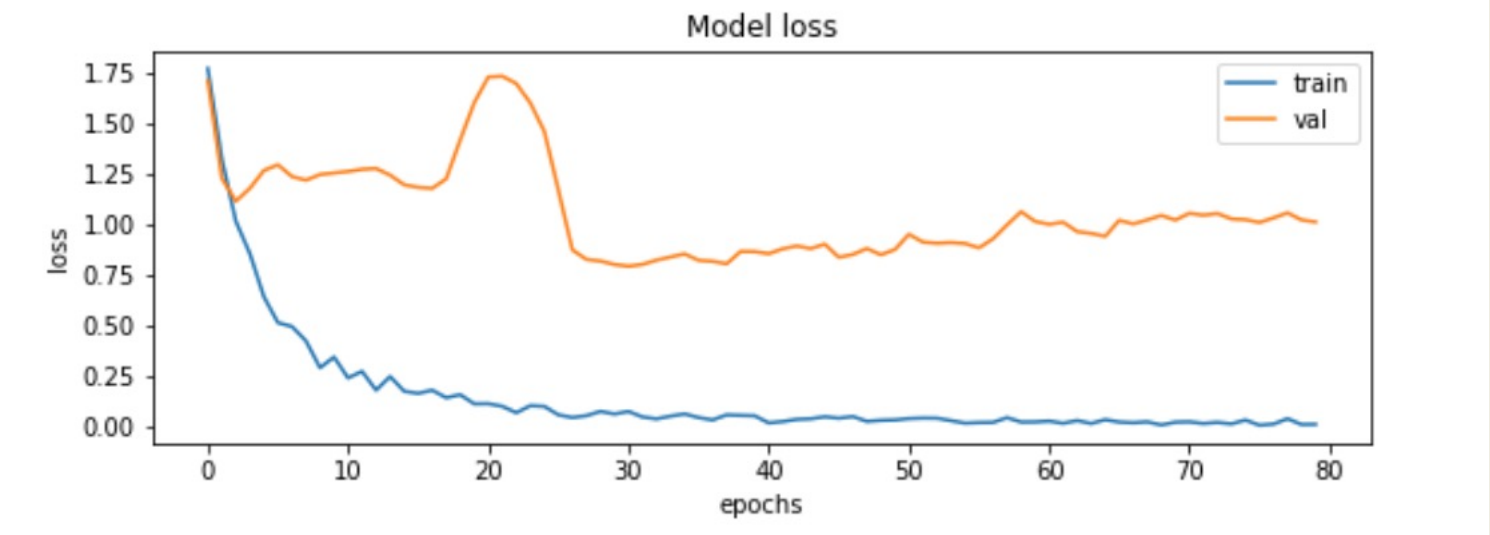
- Batch Size : 8
- Epochs : 80
- Optimizer : Adam
- Learning Schedule : Cosine Decay (3e-6 , decay step = 10000)
- Loss : Focal loss (gamma = 2)
- Metrics : accuracy

Model: Resnet 18

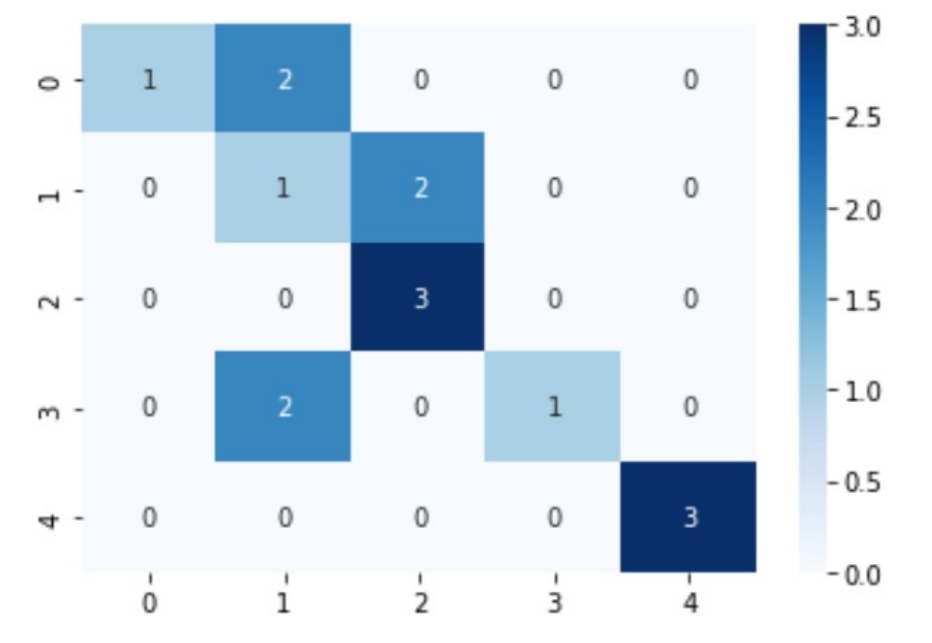
- Dropout : 0.3
- Regularizer : L2 (0.0005)
- Pre-training : Imagenet

Model Fitting





Test set



	precision	recall	f1-score	support
0	1.00	0.33	0.50	3
1	0.20	0.33	0.25	3
2	0.60	1.00	0.75	3
3	1.00	0.33	0.50	3
4	1.00	1.00	1.00	3
accuracy			0.60	15
macro avg	0.76	0.60	0.60	15
weighted avg	0.76	0.60	0.60	15

Accuracy : 0.60

Future Work

- Use Binary Classifiers for Multi-Class Classification
- Use Youden Index to Classify
- Add ED Image for Classification

Reference

- On Improved 3D-CNN-Based Binary and Multiclass Classification of Alzheimer's Disease Using Neuroimaging Modalities and Data Augmentation Methods https://www.hindawi.com/journals/jhe/2022/1302170/
- 3D CNN classification model for accurate diagnosis of coronavirus disease 2019 using computed tomography images https://www.spiedigitallibrary.org/journals/journal-of-medical-imaging/volume-8/issue-S1/017502/3D-CNN-classification-model-for-accurate-diagnosis-of-coronavirus-disease/10.1117/1.JMI.8.S1.017502.full?SSO=1#r26
- 3D image classification from CT scans https://keras.io/examples/vision/3D_image_classification/

Thank You