Multiple Types of Cancer Classification Using CT/MRI Images Based on Learning Without Forgetting Powered Deep Learning Models

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Cancer, convolutional neural network (CNN), pretrained models, Bayesian optimization, transfer learning, learning without forgetting, VGG16, VGG19, DenseNet, mobile net

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ارائه درس طراحی سیستم هوشمند خرداد ۱۴۰۲

eight kinds of cancer such as

- lung
- Brain
- breast
- and etc

Pre-trained CNN variants such as

- MobileNet
- VGGNet
- DenseNet

Transfer Learning

Bayesian Optimization

Learning Without Forgetting (LWF)

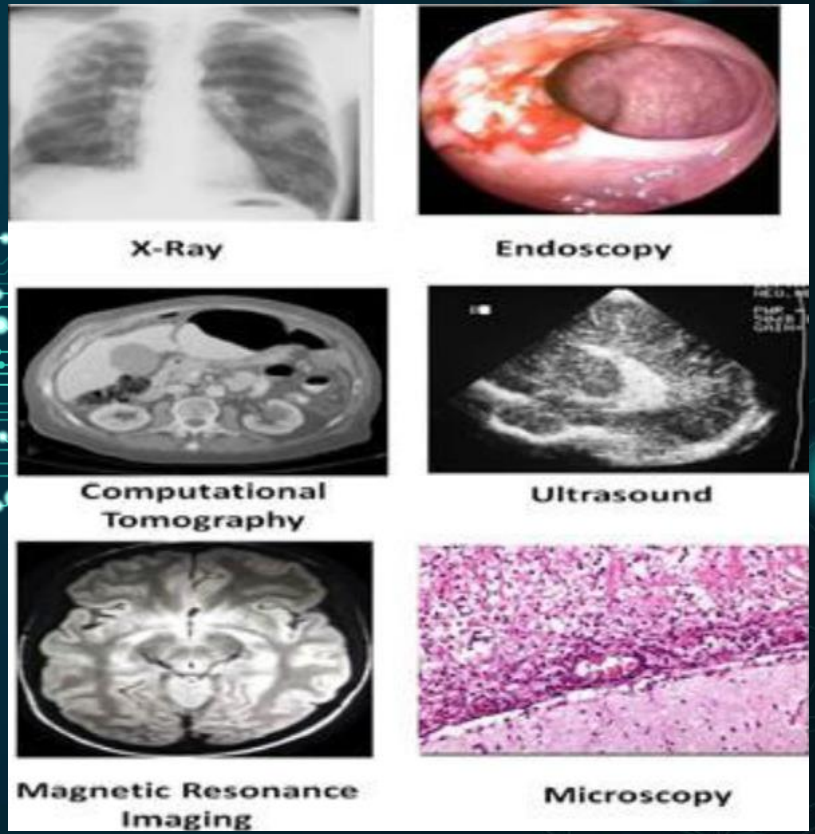
Four modalities in clinicians

1) physical examination
2) laboratory tests
3) imaging techniques
4) and biopsy

(3)

1) Computed Tomography (CT)
2) Magnetic Resonance İmaging (MRI)

- Kaggle AND Jupiter



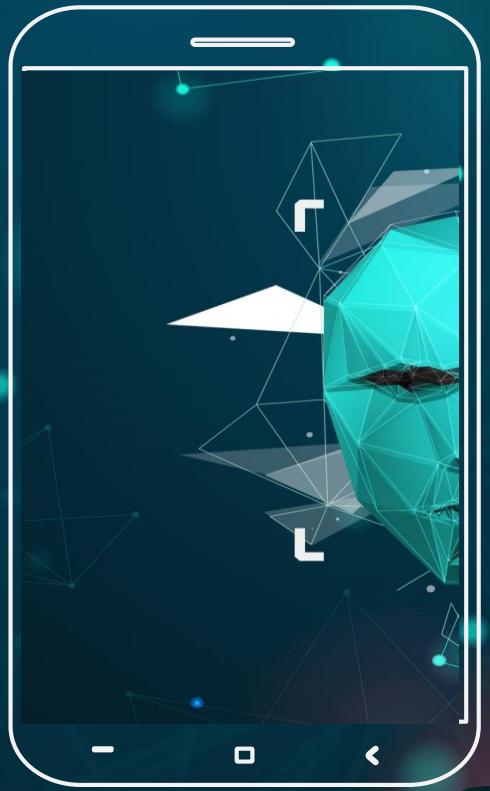
1. JPEG
2. JPG
3. PNG
4. BMP
5. NII
6. TIF

JPG AND Resized to ⇨ 224*224

Database in Kaggle : Multi Cancer Dataset

five different CNN architectures

VGG16, VGG19, DenseNet201, MobileNetV3 (Small) and MobileNetV3 (Large)



feature extraction
classifcation

convolutional and pooling
fully connected and flattened

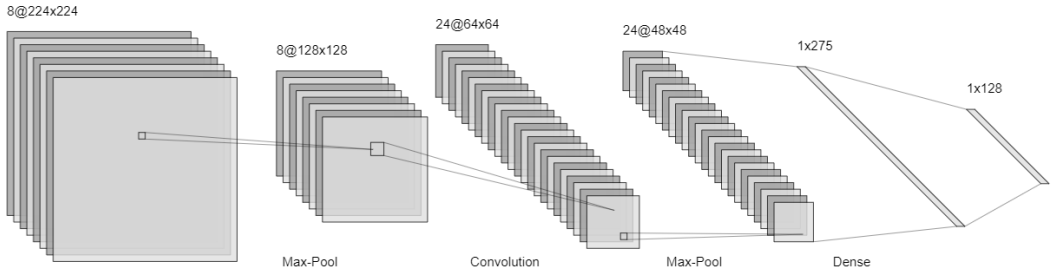
Architecture:

Depth | Height | Width | filter Height | filter Width

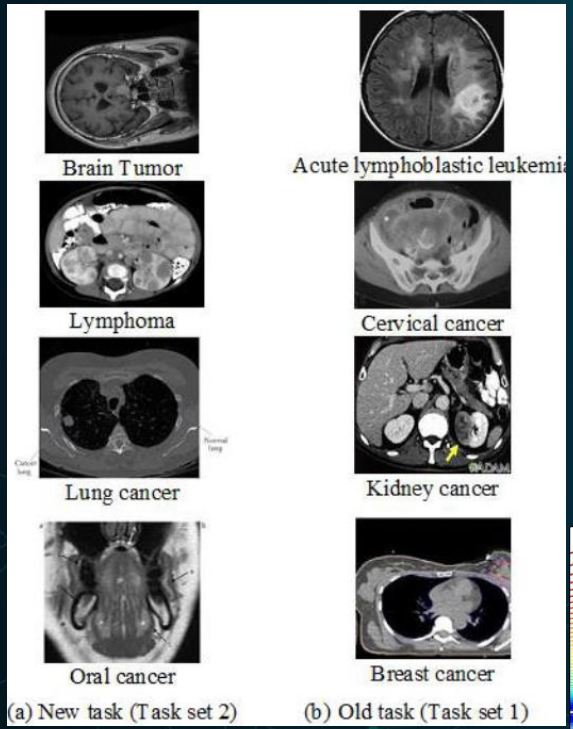
−	8	224	224	8	8
Op:	Max-Pool				
−	8	128	128	16	16
Op:	Convolution				
−	24	64	64	8	8
Op:	Max-Pool				
−	24	48	48	8	8
Op:	Dense				
+					
Op:					

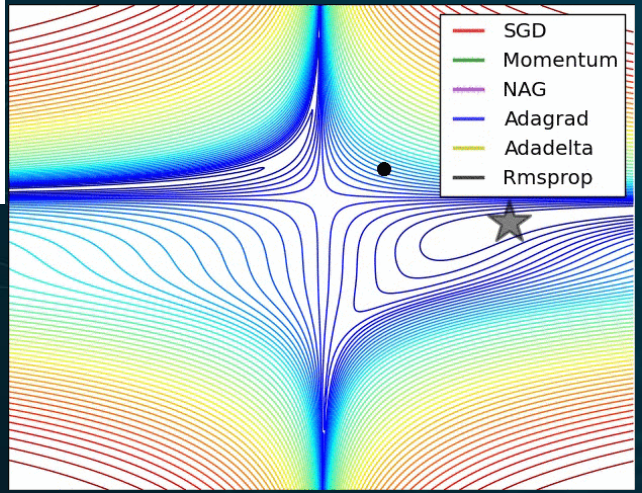
Vector Length

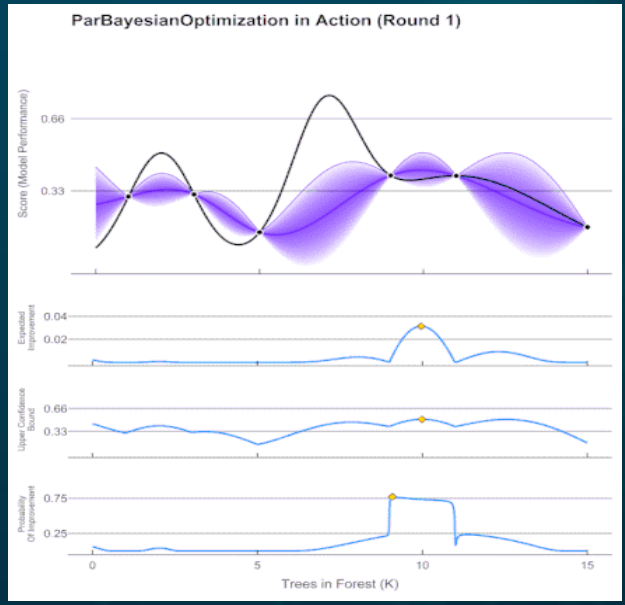
−	275
−	128



Optimizer


Brain Tumor
Acute lymphoblastic leukemia
Lymphoma
Cervical cancer
Lung cancer
Kidney cancer
Oral cancer
Breast cancer
(a) New task (Task set 2)
(b) Old task (Task set 1)


SGD
Momentum
NAG
Adagrad
Adadelta
Rmsprop


ParBayesianOptimization in Action (Round 1)
Score (Model Performance)
0.66
0.33
Expected Improvement
0.04
0.02
Upper Confidence Bound
0.66
0.33
Probability Of Improvement
0.75
0.25
0
5
10
15
Trees in Forest (K)

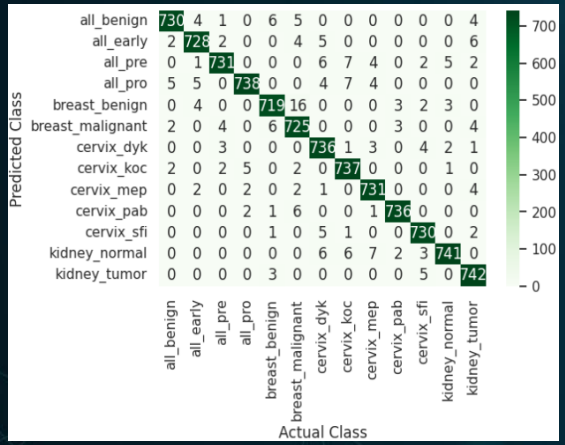
DETAILS OF EXPERIMENTS

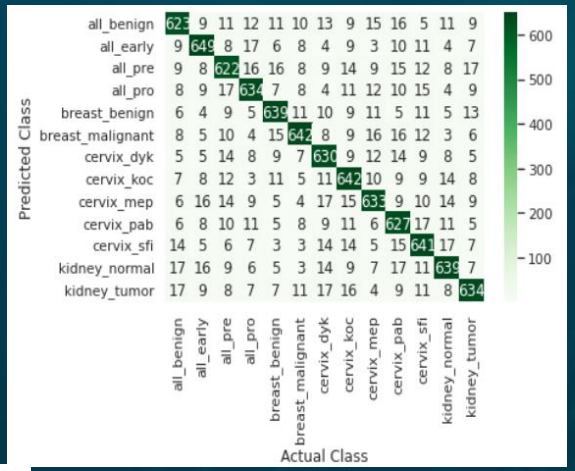
Parameters	Details
GPU	DELL 740 with EMC
RAM	128 GB
GPU RAM	32 GB
DISK	4TB
OS	Ubuntu
Language	Python
IDE	Jupyter on Google Co-laboratory

VGG16		VGG19		DenseNet201		MobileNetV3 (Small)		MobileNetV3 (Large)	
Validation Accuracy (%)	Testing Accuracy (%)	Validation Accuracy (%)	Testing Accuracy (%)	Validation Accuracy (%)	Testing Accuracy (%)	Validation Accuracy (%)	Testing Accuracy (%)	Validation Accuracy (%)	Testing Accuracy (%)
79.61	75.82	80.93	76.34	84.78	79.82	86.51	84.52	83.04	81.67

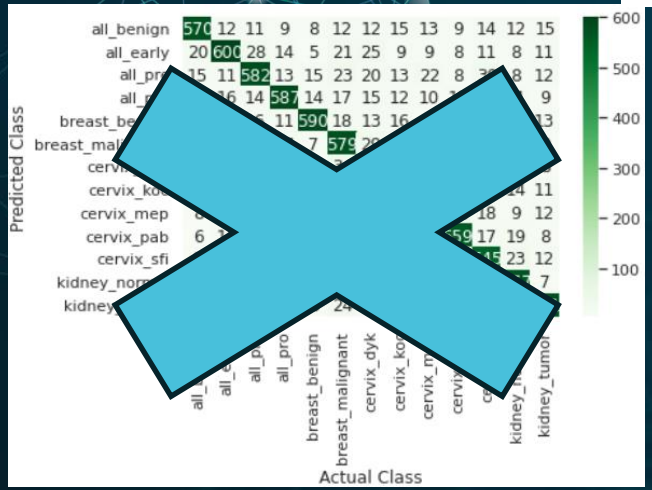
Parameter	Search Space	VGG16	VGG19	DenseNet201	MobileNetV3 Small	MobileNetV3 Large
Optimizer	RMSProp, Adagrad, ADAM, Stochastic GD, Nadam, Mini-Batch GD	ADAM	RMS Prop	ADAM	ADAM	SGD
Learning rate	1e-2, 1e-3, 1e-4, 1e-5, 1e-6	1e-4	1e-3	1e-3	1e-4	1e-2
Activation function	Relu, Elu, LeakyRelu, Parametric Leaky ReLU, Exponential LU, and Tanh	ReLU	LeakyReLU	Tanh	ReLU	ReLU
Number of neurons	32,64,128, 256, 512,1024	128	64	128	256	257
Number of epochs	50,75,100,125,150	100	125	150	100	100
Batch Size	16,32,64,128,256	32	32	128	128	128

EXPERIMENTAL RESULTS AND FINDINGS





task set 2 :
Without LwF



task set 2
:With LwF

FINDINGS AND DISCUSSION

Task set	Performance of the Models	
	Fine-tuned	LwF
Task set 1	Good	Good
Task set 2	Moderate	Good
Need for task set 1 to increase the accuracy	Yes	No

Approach	Testing Accuracy (%)				
	VGG16	VGG19	DenseNet201	MobileNetV3 (Small)	MobileNetV3 (Large)
Fine-tuned (Without LwF)	62.56	64.72	68.52	72.92	74.05
LwF	65.91	70.12	77.84	78.21	79.95

با تشکر از توجه شما

Miladkalvandi