SLIDING WINDOWS AS DATA AUGMENTATION ON HISTOPATHOLOGY IMAGES FOR CNN TRAINING

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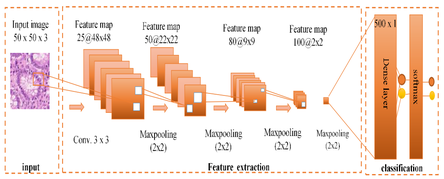
Abstract

Training with convolutional neural network (CNN) requires large amounts of data for the learning process. Small data with low variation will cause overfitting and model can not predict new data with high accuracy. On the other hand, the availability of medical data is one of the issues especially for the training process using CNN. This study will apply sliding windows to obtain data sub-samples on histopathological images. A total of 83 original data with dimensions of 775x522 were used in this study. Sliding windows is conducted from the top left with dimensions of 224x224 and 50 window-sizes. From the process, there are 3898 data sub-samples for training and 1702 for validation that can be produced. The sub-samples data then used as input for CNN for the learning process. We designed two CNN architecture to carry out the learning process. During training, some augmentation process such as rotation, flip, zoom, shear and shift are implemented to enrich the dataset. To accelerate the learning process, we use a computer with a GTX-980 GPU. The results of training using CNN can be seen through the graph with accuracy and loss function.

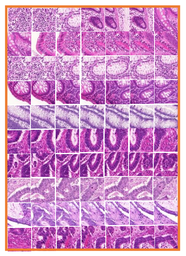
Keywords : augmentation, cnn, histopathological, sliding windows

.:: Convolutional Neural Network (CNN) ::.

CNN



Large Dataset



Require

.:: Problem Definition ::.

- Small dataset cause overfitting
- Availability of histopathology dataset is limited
- How to enrich histopathology dataset ?

Objective

- Produce histopthology dataset
- Design CNN architecture to obtain robust model

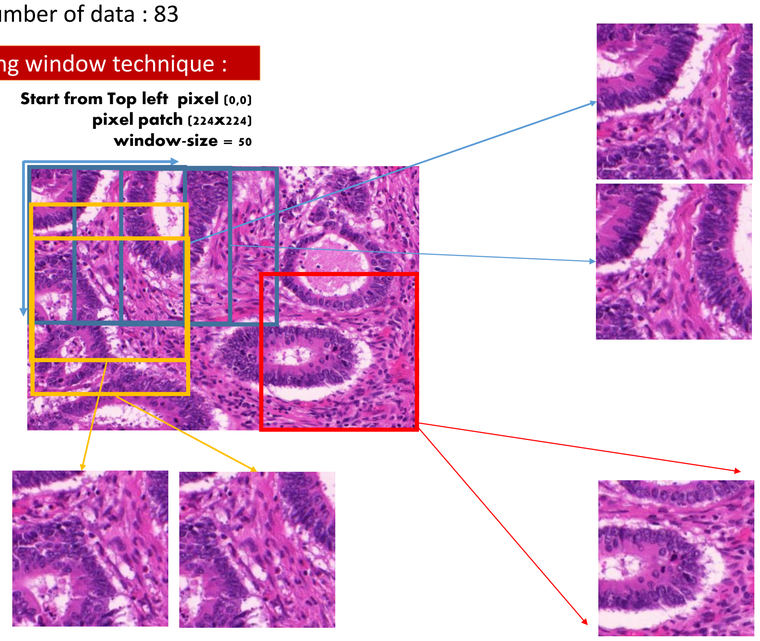
Methodology

.:: Data set ::.

- Colon cancer data, 775x522 pixel, annotated
- Number of data : 83

Sliding window technique :

Start from Top left pixel (0,0)
pixel patch (224x224)
window-size = 50



Result :

- **3898 training images**
- **1702 validation images**

Augmentation

.:: CNN Architecture ::.

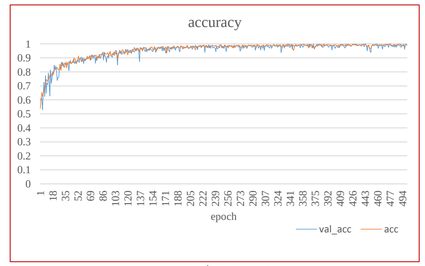
Arch	#conv	#pool	#fc	Parameters
1	4	4	1	L2 regularization = no bias regularization = no
2	7	7	3	L2 regularization = yes bias regularization = yes

GPU GTX-980 Environment :

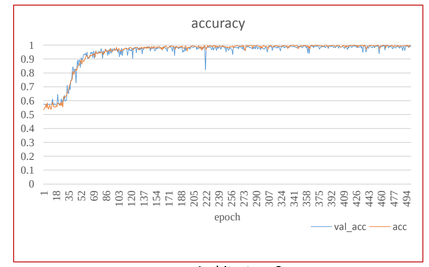
- **Number of Cores : 2048**
- **Clock speed : 1126 Mhz**
- **GPU memory : 4GB**
- **Memory interface width : 256 bit**

Result

.:: Graphics of accuracy ::.

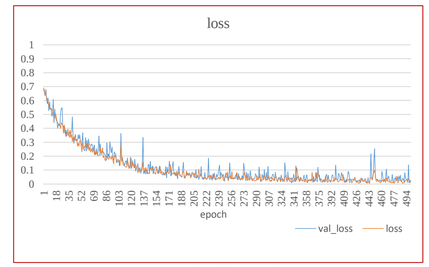


Architecture 1

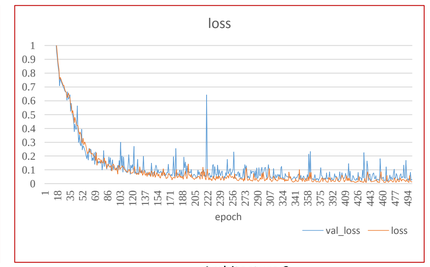


Architecture 2

.:: Graphics of loss ::.



Architecture 1



Architecture 2

Test Result

Validation data test

Architecture 1		prediction	
		benign	malignant
Aktual	benign	444	281
	malignant	116	861

Accuracy : 0.76

Validation data test

Architecture 1		prediction	
		benign	malignant
Aktual	benign	666	59
	malignant	15	962

Accuracy : 0.95

new data test

Architecture 1		prediction	
		benign	malignant
Aktual	benign	27	10
	malignant	12	31

Accuracy : 0.72

new data test

Architecture 1		prediction	
		benign	malignant
Aktual	benign	31	6
	malignant	12	31

Accuracy : 0.77

Conclusion & Future directions

- **Sliding windos can be implemented to produce histopathology dataset for CNN training**
- **Data and architecture of CNN is still improved**
- **Next, using pre-trained model can be implemented**

References

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