MATH4432 Final Project
Identification of Raphael's Paintings From the Forgeries

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ABSTRACT

To determine whether the art are real is an important work among artwork. To clarify the art forgery, experts are trained many years for different typical styles of arts. However, there are still a number of arguable and unclarified paintings among the world while they are perhaps lack of historical records or those artists are changing styles. Since the quick explore of image classification in deep learning field these years, we would try to apply those methods explored to do the artworks clarification by 2 way, self-modeling and transfer learning.

In this project, there are 3 parts of studies. First, we do the image feature extraction by gray-scaled pixels (for self sampled deep-learning) from 28x28 to 512x512 and VGG16 (for pre-trained method).

Secondly, after extracted the feature of the pictures into data from with different parameters, we apply convolutional neural network. After using VGG16, we use neural network and random forest for further transfer learning.

Finally, we would apply the best resulted model for the prediction of the given unclarified artworks.

Is it drawn by Raphael?

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DATA

The data is provided by prof. Yang WANG from HKUST.

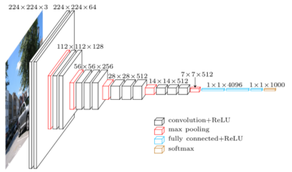
28 scanned artworks with label: "Raphael", "Non-Raphael" and "Unknown" are given for the project.

	Number
Raphael	12
Non-Raphael	9
Unknown	7

We transformed the data into 224x224 for the VGG16 feature extraction and for the gray-scaled deep-learning with CNN, we used 28x28, 32x32, 64x64, … , to 512x512 for the study.

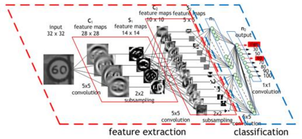
METHODS

VGG16

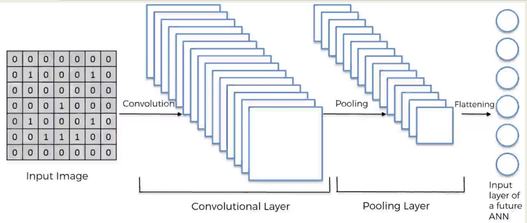


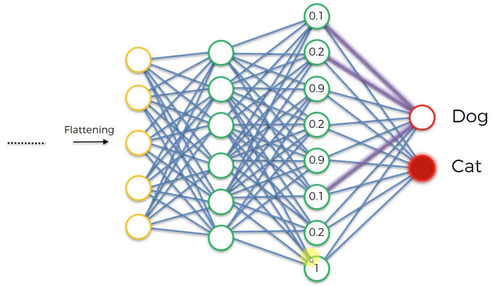
Thanks to ImageNet project, there are huge pre-trained models for feature of defeat 224x224 image extraction. The VGG16 would extract over 5-million features of a image while divided it into different layers as shown as above.

CNN

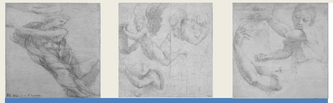


As shown above, this method would divide the features into different convolutional layers for feature detection. After extracting the convolution layer, it flattens the pooled feature map into pots of inputs and it would apply the basic NN for the clarification and prediction





RESULTS



NN with scale	CV Accuracy
28x28	0.5714
32x32	0.5714
64x64	0.5714
96x96	0.5714
128x128	0.5714
160x160	0.5714
196x196	0.5714
224x224	0.6190
256x256	0.6190

Since the sample size is typically small, we resized the given picture into gray scale and use the pixelized data for deep-learning is useless as the result shown on the left. Therefore we used pre-trained model VGG16 extraction and used CNN and random forest for improving the modeling results. The results are as follow.

For 224x224	CV Accuracy
CNN	0.8095
Random Forest	0.8095

DISCUSSION

We concluded that use the VGG16 extraction and use random forest and Convolutional Neutral Network for feature study and prediction would be highly improved the result. However, since the sample size is not large enough and we can only train it into about 80% of accuracy and further studies for better results are needed in the future like using VGG19. Try using different modeling methods like SVM, ResNet-18, ResNet-50 etc. would also be some following up works to be done the future's studies.

After modeling, the final parts would be the prediction of the unknowns (not yet clarified scanned artwork) provided. The results are as follow.

	1	7	10	20	23	25	26
CNN	Yes	No	No	No	No	No	Yes
RF	Yes	No	Yes	No	No	No	No

REFERENCES

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2. Mathwork, https://www.mathworks.com/help/nnet/ref/vgg16.html
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