Deep Learning for Distinguish AI Generated Images

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Abstract—AI painting is an emerging field. Although there is some controversy over how to use it, it is without a doubt one of the most successful applications of generative models in industrial production. How to distinguish whether a image is generated by AI is a topic that is always concerned by people, while it is not fully developed yet. In this paper, we will try to categorize this problem as an image style recognition problem, and use some well-developed models to classify AI generated images. Specifically, we will train ResNet50, fine-tuning GoogleNet and ViT on different kinds of dataset, and compared their performance based on some benchmark. Then we'll combine all the different kinds of images into one dataset and try to train models on it. We'll test our model in this way in order to see whether our model could capture some common features among different categories of AI generated images. The result of our experiments show that current image classification model could really distinguish AI generated images to a certain degree.

I. Introduction

In the last mouths, AI painting suddenly began to attract people's attention. With the implementation of the stable diffusion framework, AI painting finally showed its great potential on large scale commercial usages. People who know nothing about painting could also easily use this model to generate high quality images in just one minute. While AI painting looked really awesome, it also raised some critques, one of these is that those generated images are very homogenized, so they are unable to substitue the hand-writting pictures. Although this is a very controversial topic, we could try to think this problem in a different way: do AI generated images really have some features in common? While it might be a hard task for human eyes to distinguish these slight differences, AI itself could be a good classifier. In fact, if we think of AI-generated images as images of a certain style, then this problem is really close to the fine-grained image classification problem which we are familiar with. With the inspiration of this idea, we'll conduct a fine-grained image classification way to solve this problem in this paper.

According to the literature review, we know that there are four mainstream methods for fine-grained image classification based on deep learning:

- The first one is based on regular image classification model such as AlexNet, VGG, GoogleNet, etc. Although these models have strong representational capabilities, their performace on fine-grained classification is not very ideal. The common solution is using some pre-trained weights trained on ImageNet, then fine-tune this model to get a final result.
- The second one is the fine-grained feature learning method. In the paper [9] published in ICCV in 2015, Lin et al. proposed a bilinear convolutional neural network model to achieve a better representation of deep convolutional features. This method uses two networks, VGG-D and VGG-M, as the benchmark network. Without using the Bounding Box (border) label information, it reaches a classification accuracy of 84.1% on the CUB200-2011 dataset; while using the Bounding Box, its classification accuracy is as high as 85.1.
- The third one is object part based detection. The idea of the method based on object part detection is: first detect the position of the target in the image, and then detect the position of the discriminative area in the target, and then combine the target image and the discriminative area the target region blocks are simultaneously fed into a deep convolutional network for classification. One of the representative work is the Part-RCNN method proposed in 2014 ECCV.
- The last one is vision attention method. This method is inspired by the vision attention mechanism in human beings, and is widely adopted in computer vision afterwards. Since vision attention model could identify discriminative area in images without labels, it showed a great potential in fine-grained image classification. The recurrent attention convolutional neural network proposed in the 17-year CVPR is a representative work.

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$$a + b = \gamma \tag{1}$$

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An excellent style manual for science writers is [?].

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TABLE I
Table Type Styles

Table Head	Table Column Head		
	Table column subhead	Subhead	Subhead
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[a]Sample of a Table footnote.

Fig. 1. Example of a figure caption.

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity "Magnetization", or "Magnetization, M", not just "M". If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write "Magnetization (A/m)" or "Magnetization {A[m(1)]}", not just "A/m". Do not label axes with a ratio of quantities and units. For example, write "Temperature (K)", not "Temperature/K".

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References

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For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [?].

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