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Midterm report
Flutter beginner course - Udemy

Course: Mobile Application Development

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HA NOI - 2021

ABSTRACT

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Chapter 1

Introduction

With the growing popularity of smartphones, compact cameras, and Internet services such as Facebook and Instagram, the production and sharing of digital images has grown tremendously over the past few years. The Fig.**??** show the journey of a picture begins with it being obtained by a camera, which changes over it into a digital format and compresses it utilizing lossy compression algorithms to meet the onboard storage accessibility. This image is then transmitted over wired or wireless transmission channels and is altered in its resolution to meet the available bandwidth. Finally, the end user receives this image and watches it over devices ranging from smartphones to 4K displays, which require further alterations to its resolution.

1.1 Motivation

Most of the existing IQA databases usually contain limited distortion levels (5-6 levels) covering the whole quality range from “Bad” to “Excellent”,

1.2 Contributions

This thesis provides the following contributions:

1. **Image-Patch Quality Assessment dataset**

To our knowledge, this dataset is the first one constructing to provide benchmark for compressed image patch quality assessment, and also benefit for perceptual-based image compression. The existing databases with coarse-grained quality are inefficient to evaluate IQA algorithms especially patch-based methods on images with fine-grained quality differences. In perceptual-based image compression problem, for each coding block there are many coding modes to select

a according their rate-distortion costs. Therefore, the proposed dataset can help researchers in image compression community to select the best IQA method to do the perceptual based image optimization. 7 well-know IQA algorithms are evaluated and analyzed on the proposed database to reveal some limitations of the existing algorithms.

2. **Deep Image-Patch Neural Network Design**

We also investigate different FR methods to model the relationship between the image patch and patch quality score. After multiple of experiments, Deep Image-Patch Quality Assessment (DIPQA) is proposed to address the problem in and end-to-end optimization. We adapt the concept of Siamese networks know from classification task [1, 2] that allow for a join regression of the features extracted from the reference and distorted patch using a deep convolution neural network.

1.3 Thesis Outline

The rest of this thesis is organized as follows. After this introduction, we present the literature review in Chapter 2 in which we introduce the fields of image quality assessment and deep learning. Next, our methodology is described in Chapter 3. Chapter 4 shows the evaluation of our database and proposed neural network based on experiment result. Finally, the conclusions and future directions are given in Chapter 5.

Chapter 2

Conclusions

2.1 Conclusions

This project presents a new subject quality rating database considering local image quality assessment. Due to the lack of 'ground truth' quality of patches, we expect HMII to be a useful database for patch-based approaches. We also introduce a simple effective patch-based deep neural network that allows for feature learning and regression in an end-to-end framework. We believe that this proposed approach could achieve better result if we enlarge HMII database.

2.2 Future work

HMII Database: There are still some limitations on the proposed database to improve.

- Enlarge database to increase the number of image and them number of subject per image
- Generate more images to cover more type of distortions
- Filter with different outlier detection methods

Image-Patch model: In the future, we are planning to design more Image-Patch models and do experiments to evaluate on different databases. With DIPQA, there are some applications that we also consider:

- Applied in Image and Video Compression
- Associated a pooling state to compete with other Image and Video Quality Assessment (VQA) algorithms

- Improve current IQA/VQA algorithms

References

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[2] S. Chopra, R. Hadsell, and Y. LeCun, "Learning a similarity metric discriminatively, with application to face verification," in *Proceedings - 2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, CVPR 2005*, 2005.