

Preface

After visual signals (referring to image, video, graphics, and animation) are captured or generated, they undergo a variety of processings, including compression, enhancement, editing, retargeting, and transmission. These processes change the quality of visual signals. To measure the extent of such changes, visual quality assessment (VQA) has gained popularity as a hot research topic during the last decade. The psychological and physiological research results have been plugged into this research field to provide fundamental knowledge of the visual perception mechanism and theoretical support for developing VQA models. In addition, the newly developed computer vision, artificial intelligence, and machine learning techniques have been applied to this research field; they have cooperated with psychological/physiological principles to produce more powerful and general computational models of VQA.

On the basis of acquired knowledge about the human visual system (HVS) to visual perception, a variety of VQA approaches have been developed in seeking agreement with the perception mechanism of the HVS to visual signal stimulus. However, due to the sophisticated nature of the HVS, it is difficult to model the HVS response and perception to image/video features directly and explicitly in general, with the current understanding and knowledge on the HVS. Many model-based and signal-driven VQA systems have been developed with strong assumptions. Therefore, machine learning can be used to emulate the mechanisms of complicated models as a new trend of VQA development, without resorting to prior, unrealistic assumptions. There have been a variety of machine learning-based VQA approaches in the recent literature with increase in necessary databases publicly available. The learning-based VQA has become an emerging category of VQA, apart from the model-based and signal-driven ones.

The content of this book is arranged into six chapters. Chapter 1 is the introduction to VQA. The fundamental knowledge, history, and major approaches (including model-based, signal-driven, and learning oriented ones) of VQA are presented. The important relevant documents and major subjective database resources are also provided in this chapter to be a convenient reference for readers. Chapter 2 briefly introduces the basic concepts and methods of machine learning.

Chapter 3 states the basic and advanced image features. These features are applicable to both general machine learning tasks and for specific purposes. We also introduce the relevant issues concerning feature extraction and feature selection in this chapter. Chapter 4 gives the ML-based feature pooling strategies on VQA, where the traditional ML tools, the newly proposed pairwise rank learning approach, and an ensemble-based scheme accounting for feature pooling are presented in detail. In Chap. 5, a fusion scheme of VQA metrics is presented. This fusion scheme takes advantage of the combined metrics to overcome the shortcomings of each metric used individually. The final chapter concludes this book and gives the potential research prospects in the VQA field.

This book is mainly targeted at researchers, engineers, and students of computer science, information science, mathematics, and perception science who are interested in VQA, machine learning applications, and image/video processing.

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