領域論壇：機器學習與影像應用
Session: Machine Learning and Imaging Applications

Venue: 數學館 M210

Time	Speaker	Title of the Talk	Chair
10:20-10:45	魏澤人	Exploring With Denoising Diffusion Probabilistic Models	蔡炎龍
10:45-11:10	林佳威	A Two-Phase Optimal Mass Transportation Technique for 3D Brain Tumor Detection and Segmentation	蔡炎龍
11:10-11:35	謝博文	Retinex decomposition for low-light image enhancement	胡偉帆
11:35-12:00	陳縕儂	Towards Conversational AI	胡偉帆

Exploring With Denoising Diffusion Probabilistic Models

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Abstract

Recent advances in DDPM (Denoising Diffusion Probabilistic Models) allow us to generate high-fidelity and quality images using deep models. It is the current state-of-the-art of image generative models and beats GAN-based models in various tasks.

This talk will first briefly overview DDPM, including its relationship to score-based generative models, the diffusion process, stochastic differential equations, classifier guidance, and classifier-free guidance methods.

We will then introduce a few simple experiments to explore the conditional probability space corresponding to the diffusion models. We can see the denoising process by running the algorithm on low-dimensional spaces. We can use a technique akin to classifier guidance to guide the model to generate images with arbitrary geometric shapes or that satisfy other easily defined conditions by combining an unconditional DDPM with some known probability density. We will investigate related issues in a classifier-free guidance setting and contrast the outcomes.

Keywords Denoising Diffusion Probabilistic Models, score based generative model

References

[1] HO, Jonathan; SALIMANS, Tim. Classifier-free diffusion guidance. arXiv preprint arXiv:2207.12598, 2022.

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[3] Khrulkov, Valentin and I. Oseledets. “Understanding DDPM Latent Codes Through Optimal Transport.” ArXiv abs/2202.07477 2022.

A Two-Phase Optimal Mass Transportation Technique for 3D Brain Tumor Detection and Segmentation

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Abstract

The goal of optimal mass transportation (OMT) is to transform any irregular 3D object (i.e., a brain image) into a cube without creating significant distortion, which is utilized to preprocess irregular brain samples to facilitate the tensor form of the input format of the U-net algorithm. The BraTS 2021 database newly provides a challenging platform for the detection and segmentation of brain tumors, namely, the whole tumor (WT), the tumor core (TC) and the enhanced tumor (ET), by AI techniques. We propose a two-phase OMT algorithm with density estimates for 3D brain tumor segmentation. In the first phase, we construct a volume-mass-preserving OMT via the density determined by the FLAIR grayscale of the scanned modality for the U-net and predict the possible tumor regions. Then, in the second phase, we increase the density on the region of interest and construct a new OMT to enlarge the target region of tumors for the U-net so that the U-net has a better chance to learn how to mark the correct segmentation labels. The application of this preprocessing OMT technique is a new and trending method for CNN training and validation..

Keywords Optimal mass transportation, Brain tumor segmentation, Machine learning

References

[1] W.-W. Lin, T. Li, T.-M. Huang, J.-W. Lin, M.-H. Yueh, S.-T. Yau, *A Two-Phase Optimal Mass Transportation Technique for 3D Brain Tumor Detection and Segmentation,* , International MICCAI Brainlesion Workshop, (2022), 400-409.

Retinex decomposition for low-light image enhancement

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Abstract

Images captured in inadequate lighting conditions often suffer from uneven illumination, low contrast, and poor visibility. Such degraded images not only lead to unpleasing images for human vision but can also degrade the performance of algorithms in many computer vision applications. In this talk, we will introduce a Retinex-based variational model for low-light image enhancement. The proposed model can effectively improve the visibility of low-light images while achieving noise suppression. A number of numerical experiments and comparisons with other popular enhancement methods are conducted to demonstrate the high performance of our method.

Keywords Retinex model, image enhancement, adaptive variational model

Towards Conversational AI

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Abstract

Conversational AI is an exciting field that aims to create intelligent machines capable of carrying out human-like conversations. In recent years, advancements in deep learning and natural language processing (NLP) have led to significant progress in this area. One important breakthrough is the development of GPT and its variants (e.g. ChatGPT), which have shown remarkable performance in conversation generation. This talk aims to explain the technology behind ChatGPT and discuss the strengths and limitations of ChatGPT, including ethical considerations and potential biases. By the end of this talk, you will have a better understanding of the potential of Conversational AI and how ChatGPT can make a difference in your work. [This summary was partially generated by ChatGPT.]