DONG HUO

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Education

University of Alberta   **Sept 2018 - Jun 2024**
Ph.D., Computing Science   *Edmonton, Alberta*

Harbin Institute of Technology   **Sept 2014 - Jun 2018**
B.Eng., Software Engineering   *Harbin, Heilongjiang, China*

Research Experience (First Author)

Huawei Technologies Co., Ltd   **Apr 2023 – Present**
Associate Research Intern, advised by Juwei Lu   *Markham, Ontario*

CVPR 2024 (Under review) – Diffusion-based Texture Generation and Editing for 3D Objects

- Leveraged 2D ControlNet pipeline from diffusers to generate multi-view images, incorporating camera pose and depth information, while pioneering a novel algorithm to address view inconsistency issues and seamlessly stitch adjacent views, resulting in a significant and perceptible enhancement in texture quality.
- Demonstrated exceptional efficiency by reducing optimization time by 60% compared to the widely-adopted Score Distillation Sampling (SDS) algorithm.
- Extended the application of the method to enable global and local editing of textures, showcasing adaptability and versatility in texture processing.

Computer Graphics Lab, University of Alberta   **Jun 2019 – Mar 2023**
Research Assistant, advised by Herb Yang   *Edmonton, Alberta*

TPAMI 2023 – Blind Image Deconvolution Using Variational Deep Image Prior [code link]

- Mathematically validated the effectiveness of integrating variational Bayes with the deep image prior (DIP) to address single image blind deconvolution challenges, providing a robust theoretical foundation.
- Expanded the PyTorch implementation of the DIP framework based on our novel mathematical derivation, resulting in a more tightly constrained optimization process.
- Demonstrated a substantial 22% improvement in deconvolution performance compared to the baseline DIP method, highlighting the practical impact of our contributions in image restoration.

TIP 2023 – Glass Segmentation with RGB-Thermal Image Pairs [code link]

- Developed an innovative multi-modal fusion network that leverages both CNN and transformer modules, achieving a remarkable improvement of over 38.6% compared to 24 other related methods.
- Conducted a comprehensive physical analysis of the feasibility of combining RGB images and thermal images to enhance glass segmentation accuracy, resulting in an impressive 52% performance enhancement over using only RGB images.

TIP 2023 (Under review) – Learning to Recover Spectral Reflectance from RGB Images [code link]

- Proposed an innovative architecture based on a proprietary theorem, which seamlessly integrated the inherent physical properties of spectral reflectances. This approach led to a remarkable 10% performance improvement when compared to conventional end-to-end learning methods.
- Implemented meta-auxiliary learning techniques to effectively narrow the domain gap between training and testing data, resulting in an impressive 8% reduction in domain discrepancy.

CVPRW 2022 – Motion Deblurring using Atrous Spatial Pyramid Deformable Convolution [code link]

- Proposed a novel architecture for better generalization on non-uniform blur by using deformable convolution with different dilation rates to adaptively adjust the shapes and values of convolution kernels.
- Implemented the architecture with Pytorch and achieved 6% performance gain compared with architectures without adaptive kernels.

Projects

3D Object editing with 3D Gaussian Splatting   **Sept 2023 - Present**

- Trained a 3D Gaussian Splatting (3DGS) model using images of a specific object and subsequently generated rendered images around the object.
- Implemented a combination of ControlNet and Instruct-Pix2Pix for image editing, and adopted prompt-to-prompt methodology to ensure view consistency.
- Fine-tuned the pretrained model by incorporating point clouds aligned with edited images to facilitate both global and local editing capabilities.

Object Removal in NeRF **Apr 2023 - Jul 2023**
- Adopted the Segment Anything Model (SAM) for precise object segmentation, and utilized NeRF to generate a 3D segmentation mask specifically tailored to the isolated target object.
- Enhanced the proposal network for density resampling, followed by hole inpainting with LaMa for retraining the NeRF.
- Integrated the entire pipeline into NeRFStudio, contributing to a more versatile 3D scene modeling framework.

Diagnostic Report Generation | *Patent CN109003269A & CN109065110B* **Feb 2018 - Jun 2018**
- Trained a Fast R-CNN for lung tumor detection on CT scans with labeled bounding boxes.
- Implemented an Bi-LSTM-based diagnostic report generator and an Bi-LSTM-based entity relation extractor from diagnostic reports with TensorFlow.

Technical Skills

Languages: Python, Java, MATLAB, C/C++, SQL, Shell
Technologies/Frameworks: Pytorch, TensorFlow, JAX, NeRFStudio, ThreeStudio, Diffusers, Android, OpenCV, ROS