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MATLAB IMAGE PROCESSING

Advanced Academic Final Year Projects

2026 - 2027

TITLE & ABSTRACT

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End-to-End Image Compression With Segmentation Guided Dual Coding for Wind Turbines

PROJ24009

This project develops a MATLAB-based image compression system for wind turbine inspection images. Image segmentation is used to separate important turbine components from less significant background regions. Different coding strategies can then be applied to important and non-important image areas to improve compression efficiency. MATLAB image processing techniques are used to evaluate image quality, compression ratio, and reconstruction accuracy. The system helps reduce storage requirements while preserving important visual information for turbine inspection.

AI in Medical Imaging Informatics: Current Challenges and Future Directions

PROJ24020

This project explores the application of artificial intelligence and image processing techniques in medical imaging. MATLAB is used to preprocess medical images through filtering, enhancement, resizing, normalization, and segmentation. Different image analysis approaches can be studied for identifying patterns and abnormalities in medical scans. Performance can be evaluated using image quality and classification-related metrics. The project provides an image-processing-oriented overview of how AI can support medical image analysis.

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A Deep Cascade of Convolutional Neural Networks for Dynamic MR Image Reconstruction

PROJ24009

This project focuses on restoring images affected by multiple types of degradation such as noise, blur, and compression artifacts. MATLAB image processing techniques are used for preprocessing, degradation simulation, and quality evaluation. An attention-based restoration model can identify important image regions and reconstruct missing or distorted details. The system compares degraded and restored images using objective image-quality metrics. It aims to provide efficient image restoration with improved visual quality.

CDIR: LoRA-Inspired Attention for Efficient Composite Degradation Image Restoration

PROJ24020

This project focuses on restoring images affected by multiple types of degradation such as noise, blur, and compression artifacts. MATLAB image processing techniques are used for preprocessing, degradation simulation, and quality evaluation. An attention-based restoration model can identify important image regions and reconstruct missing or distorted details. The system compares degraded and restored images using objective image-quality metrics. It aims to provide efficient image restoration with improved visual quality.

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Cross-Modal Fusion and Classification of Hyperspectral and Panchromatic Remote Sensing Images With Deep Learning and Multiscale CRFs

PROJ24009

This project develops a MATLAB-based remote sensing image analysis system using hyperspectral and panchromatic images. Preprocessing techniques are applied to normalize and align the different image modalities. Feature information from both image sources is fused to improve land-cover classification. Multiscale segmentation and contextual analysis help refine classification boundaries. The system evaluates classification accuracy and provides visual maps of different remote sensing regions.

Deep Convolutional Neural Network for Inverse Problems in Imaging

PROJ24020

This project investigates image reconstruction problems where the original image must be recovered from incomplete or degraded measurements. MATLAB is used to simulate image degradation such as blur, noise, undersampling, and missing information. A convolutional neural network can learn the relationship between degraded and original images. The reconstructed results are evaluated using PSNR, SSIM, and visual comparison. The system demonstrates how deep learning can support computational image reconstruction.

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Identification of Melanoma From Hyperspectral Pathology Image Using 3D Convolutional Networks

PROJ24009

This project develops a MATLAB-based melanoma detection system using hyperspectral pathology images. Hyperspectral preprocessing techniques are applied to remove noise and normalize spectral information. Three-dimensional image features containing both spatial and spectral information are extracted for disease classification. The model distinguishes potentially abnormal melanoma regions from normal tissue. The system provides classification results and visual analysis to support computer-aided pathology.

Graph Convolutional Networks Enable Fast Hemorrhagic Stroke Monitoring With Electrical Impedance Tomography

PROJ24020

This project develops an image analysis system for monitoring hemorrhagic stroke using electrical impedance tomography data. MATLAB is used for signal preprocessing, image reconstruction, normalization, and visualization. Graph-based deep learning can analyze spatial relationships between reconstructed measurement regions. The system identifies changes associated with possible bleeding or abnormal tissue conditions. The approach aims to provide rapid visualization and automated analysis of reconstructed medical images.

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Complex-Valued Convolutional Neural Network With Learnable Activation Function for Frequency-Domain Radar Signal Processing

PROJ24009

This project develops a MATLAB-based radar signal processing system using frequency-domain image representations. Radar signals are transformed into suitable frequency-domain representations for visual and computational analysis. Complex-valued convolutional processing can learn both amplitude and phase-related information. MATLAB tools are used for signal transformation, visualization, preprocessing, and performance evaluation. The system aims to improve radar signal classification and recognition accuracy.

An End-to-End Depth-Based Pipeline for Selfie Image Rectification

PROJ24020

This project develops a MATLAB-based image rectification system for correcting geometric distortions in selfie images. Depth information is analyzed to identify perspective and shape distortions caused by camera position. Image warping and geometric transformation techniques are then applied to produce corrected facial images. MATLAB provides tools for feature detection, transformation, and visual comparison. The system improves facial image geometry while maintaining natural appearance.

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Pixel-Level Face Image Quality Assessment for Explainable Face Recognition

PROJ24009

This project develops a MATLAB-based system for evaluating face image quality at the pixel level. Facial images are analyzed for blur, illumination problems, noise, occlusion, and resolution issues. Image processing techniques generate quality maps highlighting problematic facial regions. These results can be used to determine whether an image is suitable for face recognition. The system provides explainable visual feedback about factors affecting facial recognition performance.

LassoNet-GNN: A Catalyst for Few-Shot Distorted SAR Image Classification

PROJ24020

This project develops a MATLAB-based classification system for distorted Synthetic Aperture Radar images. Image preprocessing techniques are used to reduce noise and normalize SAR image characteristics. Feature selection and graph-based learning can identify important spatial relationships from limited training samples. The system classifies different SAR image categories despite distortions or limited labeled data. MATLAB visualization tools are used to compare classification results and evaluate performance.

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MCI-Net: Attention Enhanced Convolutional Network Based on Remote Sensing Images

PROJ24009

This project develops an attention-enhanced remote sensing image classification system using MATLAB. Remote sensing images are preprocessed through resizing, normalization, noise reduction, and enhancement techniques. Convolutional features are extracted to identify important land-cover patterns, while attention mechanisms emphasize relevant image regions. The system classifies different geographical or environmental categories. Accuracy and visual classification maps are generated for performance analysis.

SRNet: A Semantic Reasoning Network for Small Weak Object Detection in Remote Sensing Images

PROJ24020

This project focuses on detecting small and weak objects in high-resolution remote sensing images. MATLAB image processing techniques are used for image enhancement, resizing, and object-region preparation. Semantic reasoning and deep learning features help distinguish small target objects from complex backgrounds. The system identifies object locations and generates detection results for analysis. It is suitable for applications such as infrastructure, vehicle, and environmental monitoring.

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Topology-Learnable Static-Dynamic Graph Convolutional Network for Brain Disorder Detection With Functional MRI

PROJ24009

This project develops a MATLAB-based brain image analysis system using functional MRI data. MRI preprocessing includes normalization, noise reduction, region extraction, and functional connectivity analysis. Graph-based learning represents relationships between different brain regions for detecting abnormal connectivity patterns. Static and dynamic information can be analyzed to identify differences between healthy and disorder-related brain patterns. The system provides visual and quantitative analysis of brain connectivity.

PET Image Reconstruction Using Deep Diffusion Image Prior

PROJ24020

This project develops a MATLAB-based PET image reconstruction system for improving low-quality medical images. Raw or simulated PET measurements are processed to reconstruct diagnostic images. Diffusion-based image priors can help recover meaningful structures while reducing noise and reconstruction artifacts. MATLAB is used for image preprocessing, reconstruction, visualization, and quantitative evaluation. The objective is to generate clearer PET images while preserving important anatomical information.

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SAMURAI: Motion-Aware Memory for Training-Free Visual Object Tracking With SAM 2

PROJ24009

This project develops a MATLAB-based visual object tracking system for analyzing moving objects in image sequences or video. Image preprocessing and object segmentation are performed to identify the target object. Motion information is used to maintain object identity when the target changes position or appearance. Frame-by-frame tracking results are visualized using bounding regions or segmentation masks. The system can be applied to surveillance, traffic monitoring, and general video analysis.

Regression Is All You Need for Medical Image Translation

PROJ24020

This project develops a MATLAB-based medical image translation system for converting one medical imaging representation into another. Input images are preprocessed using filtering, normalization, and intensity correction techniques. Regression-based learning estimates the relationship between source and target medical image domains. The generated images are evaluated using structural similarity and image-quality metrics. The system supports image transformation and visualization for medical analysis applications.

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A Tutorial on MRI Reconstruction: From Modern Methods to Clinical Implications

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This project implements and compares different MRI reconstruction techniques using MATLAB. MRI measurements can be simulated with undersampling, noise, and incomplete frequency-domain information. Traditional reconstruction and modern learning-based approaches can be evaluated using image quality metrics. MATLAB provides visualization of reconstructed images and reconstruction errors. The project demonstrates how reconstruction quality can influence the usefulness of MRI images for clinical analysis.

Quantitative Ultrasound Imaging of Bone: Anatomical Images, Tissue Structural Quality, and Pulsatile Blood Flow

PROJ24020

This project develops a MATLAB-based ultrasound image processing system for analyzing bone and surrounding tissue characteristics. Ultrasound signals are processed to generate anatomical and quantitative image representations. Image enhancement, segmentation, and feature extraction techniques are used to analyze tissue structure. Blood-flow-related patterns can also be visualized using suitable signal processing techniques. The system provides quantitative image measurements to support non-invasive tissue analysis.

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Deep Learning-Based Inpainting for Sparse Arrays in Ultrafast Ultrasound Imaging

PROJ24009

This project develops an image inpainting system for reconstructing missing information in ultrasound images. Sparse ultrasound measurements can produce incomplete or degraded image regions. MATLAB preprocessing techniques identify missing areas and prepare training or test data. Deep learning-based inpainting reconstructs the missing information while preserving anatomical structures. The restored images are compared with original images using visual and quantitative quality metrics.

Learning Fourier-Constrained Diffusion Bridges for MRI Reconstruction

PROJ24020

This project focuses on reconstructing MRI images using frequency-domain constraints and diffusion-based image restoration. MATLAB is used to transform MRI data between spatial and Fourier domains. Undersampled or corrupted measurements are processed to reconstruct missing image information. Diffusion-based learning can generate realistic structures while maintaining consistency with acquired measurements. Reconstruction performance is evaluated using PSNR, SSIM, and visual comparisons.

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Extending the Field of View in Modulation-Based X-Ray Phase Microtomography

PROJ24009

This project develops a MATLAB-based image reconstruction method for extending the field of view of X-ray phase microtomography images. Projection images are preprocessed to correct noise, intensity variations, and alignment errors. Reconstruction techniques combine available measurements to generate a wider image representation. Image quality is evaluated using structural and quantitative measurements. The system helps visualize larger sample regions while maintaining useful image details.

Laboratory Test-Guided Medical Image Generation for Multi-Modal Disease Prediction

PROJ24020

This project develops a MATLAB-based MRI image analysis system for estimating axon-related structural information. Diffusion MRI images are preprocessed through noise reduction, registration, normalization, and region extraction. Mathematical image analysis techniques estimate diffusion characteristics associated with axonal structures. Generated maps provide spatial visualization of estimated axon diameter information. The system supports quantitative analysis of brain white-matter microstructure.

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Axon Diameter Mapping From Myelin Water Diffusion MRI

PROJ24009

This project develops a MATLAB-based MRI image analysis system for estimating axon-related structural information. Diffusion MRI images are preprocessed through noise reduction, registration, normalization, and region extraction. Mathematical image analysis techniques estimate diffusion characteristics associated with axonal structures. Generated maps provide spatial visualization of estimated axon diameter information. The system supports quantitative analysis of brain white-matter microstructure.

Vector Flow Imaging in Layered Models With a High Speed of Sound Contrast Using Pulse-Echo Ultrasound and Photoacoustics

PROJ24020

This project develops a MATLAB-based ultrasound image processing system for estimating blood or tissue flow patterns. Pulse-echo ultrasound and photoacoustic measurements are processed to extract spatial and temporal information. Image reconstruction and flow estimation techniques generate vector representations of movement. MATLAB visualization tools display the direction and magnitude of estimated flow. The system provides quantitative imaging for analyzing flow behavior in layered biological structures.

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Learning a Filtered Backprojection Reconstruction Method for Photoacoustic Computed Tomography With Hemispherical Measurement Geometries

PROJ24009

This project develops a MATLAB-based reconstruction system for photoacoustic computed tomography. Acquired or simulated acoustic measurements are processed using filtering and backprojection techniques. Learning-based optimization can improve reconstruction quality by reducing artifacts and noise. The reconstructed images are visualized and compared with reference images using quantitative metrics. The system aims to generate clearer photoacoustic images for structural and functional analysis.

Zero-Shot Unsupervised Motion Estimation for Motion-Corrected Cardiac T1 Mapping

PROJ24020

This project develops a MATLAB-based motion estimation system for cardiac MRI sequences. Image registration techniques identify movement between consecutive cardiac images without requiring manually labeled training data. Estimated motion fields are used to align images and reduce motion-related artifacts in T1 maps. Image processing techniques improve temporal consistency across the sequence. The resulting maps provide clearer visualization of cardiac tissue characteristics.

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PETAL-3D: Progressive Elimination of Noise Toward Accurate Ultra Low-Count PET Images Using 3-D U-Nets

PROJ24009

This project develops a MATLAB-based denoising system for ultra-low-count PET images. Low-count PET data is affected by significant noise and reduced image quality. Three-dimensional image processing and U-Net-based learning can recover structural information while suppressing noise. MATLAB is used for preprocessing, volumetric visualization, and quantitative evaluation. The system aims to generate clearer PET images while preserving important anatomical and functional information.

CINeMA: Conditional Implicit Neural Multi-Modal Atlas for a Spatio-Temporal Representation of the Perinatal Brain

PROJ24020

This project develops a MATLAB-based framework for analyzing longitudinal medical images of the developing brain. Multiple imaging modalities are registered and normalized to create a common spatial representation. Temporal image processing helps visualize brain development across different time points. Deep learning can support generation and prediction of missing or intermediate anatomical representations. The system provides visual and quantitative analysis of perinatal brain development.

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Diff-Def: Diffusion-Generated Deformation Fields for Conditional Atlases

PROJ24009

This project focuses on generating deformation fields for aligning medical images into a common anatomical space. MATLAB image registration techniques are used to preprocess and align medical image datasets. Diffusion-based models can generate smooth deformation fields that represent anatomical variations. The resulting transformations are visualized using deformation maps and registered images. The system supports atlas construction and comparative medical image analysis.

Splatting SA: Direct Rendering of Synthetic Aperture Imagery

PROJ24020

This project develops a MATLAB-based image rendering system for synthetic aperture imagery. Multiple measurements are processed and combined to generate a visual representation of the observed environment. Image reconstruction and rendering techniques are used to improve spatial information and visualization quality. MATLAB provides tools for filtering, transformation, and image display. The system can support radar imaging, remote sensing, and computational imaging applications.

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Time-Variant Image Inpainting via Interactive Distribution Transition Estimation

PROJ24009

This project develops a MATLAB-based image inpainting system for restoring missing or damaged regions that change across image sequences. Missing regions are identified using image masks and temporal information. Image processing techniques analyze surrounding spatial and temporal patterns to reconstruct the missing content. Learning-based estimation can improve consistency between consecutive frames. The system produces visually coherent restored images for video and time-varying image applications.

Performance Evaluation of the Time-of-Flight Biograph Vision.X: A Fast Coincidence Time Resolution PET/CT Scanner

PROJ24020

This project develops a MATLAB-based image quality evaluation system for PET/CT imaging performance. PET and CT image data can be analyzed for spatial resolution, noise, contrast, and signal characteristics. MATLAB image processing techniques are used to calculate performance metrics and generate comparative visualizations. Different acquisition conditions can be evaluated to understand their effect on reconstructed image quality. The system supports quantitative assessment of PET/CT imaging performance.

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GM-ABS: Promptable Generalist Model Drives Active Barely Supervised Training in Specialist Model for 3D Medical Image Segmentation

PROJ24009

This project develops a MATLAB-based 3D medical image segmentation framework with limited labeled training data. Medical volumes are preprocessed using normalization, filtering, registration, and region extraction. A general segmentation model can provide initial segmentation guidance, while active learning identifies informative samples for specialist model training. Segmentation performance is evaluated using Dice score, accuracy, and overlap measurements. The system aims to reduce manual annotation requirements while improving 3D medical image segmentation.

GCL-MIH: A Generative-Based Coverless Multi-Image Hiding Method

PROJ24020

This project develops a MATLAB-based image security system for hiding information across multiple images without directly altering their visible content. Image features are extracted and analyzed to establish a secure relationship between secret information and cover images. Generative learning techniques can improve the representation of hidden information. MATLAB image processing tools are used for encoding, decoding, visualization, and security evaluation. The system provides a covert method for protecting and sharing sensitive information through images.

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Low-Light Image Enhancement via Diffusion Models With Semantic Priors of Any Region

PROJ24009

This project develops a MATLAB-based low-light image enhancement system for improving visibility in dark images. Image preprocessing techniques analyze brightness, contrast, noise, and color information. Diffusion-based enhancement can generate improved image details while preserving important semantic regions. MATLAB is used to compare original and enhanced images using brightness and quality measurements. The system is useful for surveillance, photography, and low-visibility computer vision applications.

FIESTA: Fourier-Based Semantic Augmentation With Uncertainty Guidance for Enhanced Domain Generalizability in Medical Image Segmentation

PROJ24020

This project develops a MATLAB-based medical image segmentation framework designed to improve performance across different imaging datasets. Fourier-domain image processing is used to create controlled variations in image appearance while preserving important anatomical structures. Semantic augmentation generates additional training examples to improve model robustness. Uncertainty analysis identifies segmentation regions where predictions may be unreliable. The system evaluates segmentation performance across different image domains using standard accuracy and overlap metrics.

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A Metric and Method for Calculating Energy-Preserving Spatiotemporal Cavitation Dose: Cavitational Radiated Energy Density (CRED)

PROJ24009

This project develops a MATLAB-based image and signal processing method for analyzing cavitation activity in ultrasound applications. Ultrasound measurements are processed to estimate spatial and temporal cavitation characteristics. Energy-related features are calculated to represent the intensity and distribution of cavitation events. MATLAB visualization tools generate spatiotemporal maps for analysis. The system provides quantitative measurements that can support ultrasound treatment monitoring and safety assessment.

SUP-Net: Slow-Time Upsampling Network for Aliasing Removal in Doppler Ultrasound

PROJ24020

This project develops a MATLAB-based Doppler ultrasound image enhancement system for reducing aliasing artifacts. Doppler ultrasound data is preprocessed to improve signal quality and identify slow-time sampling limitations. An upsampling network can reconstruct missing temporal information and improve flow visualization. MATLAB is used for image reconstruction, visualization, and comparison of Doppler results. The system aims to provide clearer blood-flow representations with reduced aliasing effects.

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Exploiting Cognition in ISAR Processing for Spectral Compatibility Applications

PROJ24009

This project develops a MATLAB-based inverse synthetic aperture radar image processing system. Radar signals are transformed into ISAR images using appropriate signal processing and image reconstruction techniques. Image enhancement and feature extraction methods improve the representation of target structures. Cognitive processing can be used to identify relevant patterns and distinguish different radar targets. The system provides visual and quantitative analysis for radar imaging applications.

Temporal Conditioning for Longitudinal Brain MRI Registration and Aging Analysis

PROJ24020

This project develops a MATLAB-based longitudinal brain MRI registration system for analyzing changes across multiple time points. MRI images are preprocessed using noise reduction, intensity normalization, and spatial alignment. Registration techniques establish correspondence between brain structures across different scans. Temporal analysis helps identify structural changes associated with aging. The system produces registered images, difference maps, and quantitative measurements of brain changes.

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Explainable Intermodality Medical Information Transfer Using Siamese Autoencoders

PROJ24009

This project develops a MATLAB-based framework for transferring information between different medical imaging modalities. Images from different modalities are preprocessed and transformed into comparable feature representations. Siamese autoencoders learn relationships between corresponding image information while preserving important structural characteristics. Explainable visualization highlights regions contributing to the generated representation. The system supports multimodal medical image analysis and comparison.

Phase Correction of MR Spectroscopic Imaging Data Using Model-Based Signal Estimation and Extrapolation

PROJ24020

This project develops a MATLAB-based signal and image processing system for correcting phase errors in MR spectroscopic imaging data. Acquired spectral information is analyzed to identify phase inconsistencies and signal distortions. Model-based estimation techniques predict the appropriate phase correction parameters. Corrected data is transformed into improved spectral or spatial representations. MATLAB visualization and quantitative analysis are used to evaluate the effectiveness of the correction method.

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An End-to-End Optimized Lensless System for Privacy-Preserving Face Verification

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This project develops a MATLAB-based privacy-preserving face verification system using lensless imaging. Lensless image measurements are computationally reconstructed to obtain useful facial information without requiring conventional camera optics. Image preprocessing and feature extraction are applied to the reconstructed images. A face verification model compares extracted features to determine whether the identity is genuine. The system aims to improve privacy while maintaining effective facial verification performance.

High-Speed Correlation-Based 2-D In-Plane Motion Sensing With Single-Nanometer Precision

PROJ24020

This project develops a MATLAB-based image correlation system for detecting extremely small two-dimensional object movements. Sequential images are processed using correlation and feature-matching techniques. Sub-pixel estimation improves the precision of measured displacement between image frames. MATLAB provides visualization of motion vectors and calculated displacement values. The system can support precision measurement, microscopy, manufacturing inspection, and scientific imaging applications.

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Microbubble Backscattering Intensity Improves the Sensitivity of Three-Dimensional Functional Ultrasound Localization Microscopy

PROJ24009

This project develops a MATLAB-based ultrasound image processing system for analyzing microbubble signals in three-dimensional imaging. Ultrasound data is filtered and reconstructed to identify microbubble backscattering responses. Image localization techniques determine the position and movement of microbubbles within the imaging volume. Signal intensity measurements are used to improve visualization of small vascular structures. The system supports high-resolution analysis of blood-flow-related ultrasound images.

StarIR: Convolutional Image Restoration With Spatial-Frequency Fusion

PROJ24020

This project develops a MATLAB-based image restoration system using spatial and frequency-domain information. Degraded images are analyzed using filtering, Fourier transformation, and convolution-based feature extraction. Spatial features preserve local structures while frequency features help recover fine details and remove degradation. The restored image is evaluated using PSNR, SSIM, and visual comparison. The system can be applied to denoising, deblurring, and general image restoration tasks.

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JustRAIGS: Justified Referral in AI Glaucoma Screening Challenge

PROJ24009

This project develops a MATLAB-based medical image processing system for glaucoma screening from retinal fundus images. Image preprocessing improves illumination, contrast, and retinal structure visibility. Segmentation and feature extraction are used to analyze the optic disc, optic cup, and related retinal characteristics. A classification model determines whether an image requires further medical referral. Explainable visual outputs can highlight relevant regions supporting the screening decision.

Bridging Component Learning With Degradation Modelling for Blind Image Super-Resolution

PROJ24020

This project develops a MATLAB-based blind image super-resolution system for improving the resolution of unknown degraded images. The system first analyzes degradation characteristics such as blur, noise, compression, and low resolution. Image restoration and super-resolution techniques reconstruct high-resolution details without requiring prior knowledge of the degradation process. MATLAB is used for preprocessing, reconstruction, visualization, and image-quality evaluation. The system aims to generate sharper and more detailed images from real-world low-quality inputs.

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