Maniratnam Mandal

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Education

Ph.D. in Electrical and Computer Engineering — ***2020 – 2024***
The University of Texas at Austin — GPA: 4.0/4.0

M.Tech. in Electrical Engineering — ***2018 – 2019***
Indian Institute of Technology Kanpur, India — GPA: 10.0/10.0

B.Tech. in Electrical Engineering — ***2014 – 2018***
Indian Institute of Technology Kanpur, India — GPA: 9.1/10.0

Foundation Masters – Signal, Control, and Robotics — ***2018***
Semester Exchange at École Centrale de Nantes, France — GPA: 10.0/10.0

Areas of Interest

- Image and Video Processing • Computer Vision (CV) • Computational Photography • Vision Models
- Video Engineering • Image & Video Quality Assessment • Accessible Media Technology • Data Science

Research and Work Experience

Graduate Research Assistant — ***Jan'20 – Dec'24***

Laboratory of Image and Video Engineering (LIVE), UT Austin — *Austin, Texas*
Supervisor: ***Dr Alan C Bovik***

- **Text Legibility and Quality Assessment for UGC Media** (Sponsor: **YouTube**)
  - Created and analyzed **unique** subjective **datasets** for assessing text legibility and quality in visual media.
  - Developed **SOTA** deep learning **models** for text-in-image legibility and text-in-video quality prediction.
- **Subjective Portrait Region Cropping for UGC Video** (Sponsor: **YouTube**)
  - Developed the **largest** subjective **video cropping database**, advancing aspect ratio transformation research.
  - Conducted in-lab human study to analyze subjective video cropping techniques for portrait content creation.
- **Image Quality Assessment for Visually Impaired UGC** (Sponsor: **Meta AI**)
  - Created the **largest dataset** for image quality and distortion analysis for visually impaired UGC.
  - Developed a **multi-task scalable model** and real-time applications to provide quality and distortion feedback.
- **Video Quality Assessment for UGC Media** (Sponsor: **Meta AI**)
  - Created the **largest UGC** video quality database and conducted the largest subjective VQA study to date.
  - Developed a SOTA **blind video quality predictor** capable of generating spatial and temporal quality maps.

Research Intern — ***Jun'22 – Aug'22***

SMI Lab, Samsung Research America — *Plano, Texas*

- Designed an in-lab **Video Quality of Experience Study** involving real-time ratings for streaming applications.
- Analyzed video quality metrics for assessing **spatio-temporal anomalies** generated during data transmission.
- Assisted in modeling QoE anomalies prediction from Network Layer statistics.

Undergraduate Researcher — ***Jul'18 – Jun'19***

Computer Vision Laboratory, IIT Kanpur — *Kanpur, India*
Supervisor: ***Dr K S Venkatesh***

- Proposed a novel method of **quasi-orthographic surface imaging** and analyzed it on generated topographies.
- Designed algorithms to compute imaging surfaces, derive bounds on imaging distance, and optimize capture points.
- Developed and compared sequential and batch filling algorithms for efficient surface reconstruction.

Research Intern — ***Jul'18 - Sep'18***

Checko, IIT Kanpur — *Kanpur, India*

- Developed 3D tag **counterfeit detection** pipeline based contrast gradients, reflection patterns, and print features.
- Implemented advanced **encryption** and **watermarking** techniques across Frequency, DCT, and Wavelet domains.

Relevant Publications

Conferences

- M. Mandal, N. Birkbeck, B. Adsumilli, and A. C. Bovik, "*LegiT: Text Legibility for User-generated Media*," IEEE International Conference on Image Processing (**IEEE ICIP**), **2024 (Oral Presentation**).
- C. Lee, M. Mandal, N. Birkbeck, Y. Wang, B. Adsumilli, and A. C. Bovik, "*Subjective Portrait Region Cropping on Landscape Video Study*," IEEE International Conference on Image Processing (**IEEE ICIP**), **2024**.
- Z. Ying, M. Mandal, D. Ghadiyaram, A. C. Bovik, *"Patch-VQ: 'Patching up' the Video Quality Problem*," IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), **2021** (**Oral Presentation**).

Journals

- M. Mandal, N. Birkbeck, B. Adsumilli, and A. C. Bovik, "*Quality Prediction of Embedded and Overlaid Text in User-Generated Visual Content*," IEEE Transactions on Image Processing (**IEEE TIP**), **2024** (under review).
- M. Mandal, D. Ghadiyaram, D. Gurari, and A. C. Bovik, "*Helping Visually Impaired People Take Better Quality Pictures*," IEEE Transactions on Image Processing (**IEEE TIP**), vol. 32, pp. 3873–3884, **2023**.

Theses

- Maniratnam Mandal, "*No-reference Image and Video Quality Assessment for User-generated Media*," **Ph.D. Dissertation**, (The University of Texas at Austin, 2024).
- Maniratnam Mandal, "*Optimum Methods for Quasi-Orthographic Surface Imaging*," **M.Tech. Thesis**, (Indian Institute of Technology Kanpur, 2019).

Teaching Experience

Teaching Assistant — *2018 – 2019*

Department of Electrical Engineering, IIT Kanpur

- Worked as a TA for courses – **Introduction to Electronics**, **Image Processing**, and **Solid State Devices**.
- Responsible for assistance in course tutorials, guidance in course projects, and grading assignments and exams.

Volunteer Member — *2018 – 2020*

English Proficiency Program, IIT Kanpur

- Management of the courses – **English Proficiency and Scholarly Communication** and **Practical English: Learning and Teaching** (online).
- Responsible for creating video lectures, and crafting and grading of assignments.

Awards

- Awarded **Outstanding TA Award** by Dept. of Electrical Engineering, IIT Kanpur, **2019**.
- Awarded **Academic Excellence Award** by IIT Kanpur for **consecutive academic years 2014 – 18**.
- Recipient of **Erasmus+** EU scholarship for semester exchange in France, **2018**.
- Awarded **Kishor Vaigyanik Protsahan Yojana (KVPY)** scholarship by DST, Govt. of India, **2013**.

Selected Coursework

Engineering	Digital Video; Image Processing; Advanced Computer Vision; Vision Systems; Computer Programming and Data Analysis; Data Mining; Embedded and Cyber-physical Systems; Statistical Machine Learning; Digital Signal Processing; Speech Signal Processing
Mathematics	Probability and Statistics; Linear Algebra; Complex Analysis and Differential Equations; Convex Optimization; Statistical Signal Processing
Certifications	Machine Learning (Stanford Online); Introduction to Neural Networks and PyTorch (IBM); Deep Learning Specialization (Deeplearning.ai); TensorFlow Developer Specialization (Deeplearning.ai); Generative Adversarial Networks (GANs) Specialization (Deeplearning.ai); Introduction to Image Generation (Google)

Technical Skills

Programming	Python, MATLAB, Javascript, HTML, CSS, Git, Bash, LaTeX
Tools	TensorFlow, PyTorch, Scikit-Learn, Scikit-image, Scikit-video, OpenCV, Darts

Additional Projects

Kaggle Competitions

❑ **Store Sales – Time Series Forecasting** ***2024***
- Ranked in **top ten** out of 762 teams with a Root Mean Squared Logarithmic **Error of 0.378**.
- Built and optimized **ensemble models** using **XGBoost**, **LightGBM**, and **TiDE**, leveraging advanced time series techniques, including past covariates, future covariates, and lag features, to improve forecasting accuracy.

❑ **Intruder Detection through Webpage Session Tracking** ***2023***
- Boosted **F1 score** to **0.91** in web-user identification by addressing imbalance with downsampling and weighting.
- Ranked in **top fifty** out of 5580 teams, achieving **ROC AUC of 0.969**, using **Light AutoML** to train LightGBM, LR, and XGBoost ensembles.

❑ **Predicting Domestic Flight Delays** ***2022***
- Ranked **first** on the leaderboard, achieving **ROC AUC of 0.959**, using a tuned **CatBoost** model.
- Leveraged Random Forest to generate new features for **binary classification**, improving AUC in a highly imbalanced dataset by utilizing class weights and implementing a custom focal loss function.

Computer Vision

❑ **Combining Compression Techniques for Computer Vision** ***2021***
- Compared compression efficacy of **quantization**, **pruning**, and **knowledge distillation** for smaller networks.
- Analyzed the combination of different techniques when applied partially and sequentially to deep networks.

❑ **Improving Defensive Distillation using Teacher Assistant** ***2021***
- Evaluated **distilled models** for different distillation temperatures in terms of accuracy, sensitivity, and robustness.
- Demonstrated that multi-step distillation improves **robustness against adversarial attacks** in most cases.

❑ **Foreground Detection and Background Separation in Videos** ***2020***
- Explored algorithms based on **PCA**, **GMM**, and **foreground motion estimation** for detecting moving subjects.
- Developed algorithms based on motion estimation for removing moving objects to extract the static background.

❑ **Deep-fake Image and Video Detection Techniques** ***2020***
- Surveyed different categories of **facial manipulation** in videos and images, and databases available for research.
- Analyzed both classical and learning-based popular Deep-fake detection techniques.

General

❑ **COVID-19: Impacts and Insights** ***2020***
- Modeled death and case projections in target demographics using **time-series analysis** and **LSTMs**.
- Applied ML techniques to analyze and predict the impact of the pandemic on mental health and well-being.

❑ **Comparison of HRTF Pre-processing Techniques** ***2019***
- Investigated the **perceptual effect** of Head Related Transfer Function (HRTF) pre-processing techniques.
- Demonstrated using **energy analysis** that lower order SHT coefficients can be used for faster reconstruction.

❑ **Robust Optimization in Logistics** ***2019***
- Studied the **retailer-supplier flexible commitment (RSFC)** problem to manage the supply chain logistics.
- Implemented and analyzed three algorithms for optimizing the parameters based on uncertainty in demand.

❑ **Online Reconstruction from Big Data via Compressive Censoring** ***2018***
- Studied **Sparsity-aware Censored Maximum Likelihood Estimator (SC-MLE)**, and tested the performance and convergence of the proposed optimization algorithm on sparse online data for real-time processing.

Positions of Responsibility

- **Internship and Company Coordinator (2015-16):** Managed college placement procedures and involved in creating preparation guides as a member of the **Student Placement Office, IIT Kanpur**.
- **Student Guide and Academic Mentor (2015-16):** Member of the **Counselling Service, IIT Kanpur**, responsible for the orientation, and academic and personal guidance of the undergraduate freshmen batch.

References

Up to three references available on request