Sandeep Mishra

Senior Research Engineer

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Research Interests: Computer Vision, Deep Learning, Cognitive Learning, Bio-inspired Vision, Efficient Learning

EDUCATION

Indian Institute of Technology Kharagpur, India
BTech(E & ECE) + MTech Dual Degree in Visual Information and Embedded Systems   *2014 - 2019*
Minor in Computer Sc. & Technology
Cumulative GPA: 8.7/10

PUBLICATION

RecSal : Deep Recursive Supervision for Visual Saliency Prediction
Sandeep Mishra* and *Oindrila Saha**
British Machine Vision Conference (BMVC), 2020   * - equal contribution

RESEARCH PROJECTS

- **Biologically Inspired Saliency Prediction**   IIT Kharagpur
  *Independent Project, **BMVC'20***   *2019 - 2020*
  - Proposed optimising a different loss per output map & a multi-decoder model to exploit all levels of features.
  - Extracted temporal and sequential metadata from existing datasets to provide extra supervision for saliency detection.
  - Designed recursive blocks to provide bio-inspired supervision with temporally/spatially sequenced metadata.
  - Outperformed previous SOTA methods with 50-80% fewer parameters, while also performing consistently well across all evaluation metrics unlike prior art methods.

- **Joint embedding space for Image and Text analysis**   IIT Kharagpur
  Master Thesis, Guide: Prof. Debashis Sen   *2018 - 2019*
  - Designed a encoder network to extract a feature vector representation of an image.
  - Generated feature vector representation for a caption of the same image using LSTMs.
  - Proposed various ranking methods to compute a similarity score between the vectors generated and trained the networks using these scores as loss function.

- **Fuzzy Bayesian surprise model for Human Attention**   IIT Kharagpur
  Bachelor Thesis, Guide: Prof. Debashis Sen   *2017 - 2018*
  - Saliency maps for each frame of a video input were computed based on features like color, intensity and motion.
  - The surprise for each frame w.r.t. its previous frames was computed by using a fuzzy Bayesian probabilistic model.
  - The location with maximum surprise was selected as the point of attention(winner-take-all criteria).
  - Extensive comparison of the above method with SOTA was done w.r.t. the ground truth/eye tracking data.

- **Filtering By Aliasing based sharp cut-off filter**   UCLA
  Remote Internship, Guide: Dr. Sudhakar Pamarti   *2016 - 2017*
  - **MATLAB modelling:** Designed a bit precision based periodic signal d(t) which when multiplied by the input and then sampled at a particular frequency gets aliased in such a way that the original signal is retrieved back.
  - Implemented an analog version of the same d(t) by using only the first 9 Fourier coefficients of the spectrum and then used triangular shaped pulses to recreate d(t) with tolerable error margin.
  - **Cadence Virtuoso Design:** Simulated all circuit blocks in Cadence Virtuoso which were used in the final design.

RESEARCH AND DEVELOPMENT EXPERIENCE

- **SRIB - Samsung R&D Institute Bangalore**   Bangalore, India
  Senior Research Engineer - Research, Visual Intelligence Group (VIG)   *2019 - Present*

  ### AI Gallery Zoom
  - Conceptualized and developed a novel low complex CNN ($\approx 2K$ parameters) based pipeline for Image Super-Resolution to replace the traditional hardware scalar used in Smartphone Gallery.
  - Trained the neural networks and developed classification and detection modules to handle multiple sources of images in Gallery to produce artifact free super-resolved images in all scenarios.
  - The end to end AI Gallery Zoom solution is commercialized in more than 10 latest Samsung Mid-Tier mobile phones and is planned for upcoming flagship mobile phones in 2021.
  - Awarded **Citizen Award** and **Spot Award** for remarkable contribution in achieving superlative quality in AI Gallery Zoom models and successful commercialization.

AI Video Super Resolution

- Developed a Video SR solution (on top of optical zoom of 4x) for video capture pipeline of Samsung smartphones with very low power requirements and real time application.
- Generated synthetic data for training for Tele-Lens case since conventional SR datasets are not useful for this task.
- Implemented unsupervised Cycle GAN based training procedure to apply domain transfer from wide-lens dataset to Tele-lens dataset (self captured) and generated synthetic data for training Super resolution network.
- SR networks when trained on this synthetic data produced outputs with highly enhanced details, sharpness and reduced noise levels as compared to the existing solutions (using convention datasets) without introducing any artifacts.
- Awarded **Spot Award** for remarkable contribution in validating PoC on achieving high quality Super-Resolution on videos captured through Tele-Lens.

- **SRIB - Samsung R&D Institute Bangalore** Bangalore, India
  Research Intern, Visual Intelligence Group (VIG) *Summer 2018*
  - Developed a deep CNN based 3D Human Pose estimation model using a single RGB camera without a depth sensor.
  - Implemented VNect decoder along with MobileNetV2 encoder and ResNet50 encoder and tested their performance.
  - Achieved real time applications with a significantly small sized model that could be implemented on a mobile device.

- **Mentor Graphics, a Siemens Business** Noida, India
  Software Intern, Veloce Emulation Platform - Testing team *Summer 2017*
  - Observing performance variation caused by Out-Of-the-Blue Calls to pin point the exact reason for the variation.
  - Writing a test case for searching a particular data in a Flexmem from the HVL(Software) side.
  - GUI dump checks for Veloce v1704 for comparing results of any simulation with its GOLD files.
  - Testing the new CRD writer API for any relevant bugs before its release in the upcoming versions of Veloce.

TERM PROJECTS

- **Super Resolution using MobileNet** IIT Kharagpur
  Neural Networks Term Project, Guide: Prof. Debashis Sen *Fall 2018*
  - Created a network based on MobileNet for real time applications of SR such as video calls and streaming.
  - Used depthwise separable convolution to reduce number of parameters of the network to less than $7X$ of SOTA.
  - Performs competitively with the SOTA - EDSR, WDSR and SRGAN with a lower complexity network.

- **Imposter detection using keystroke dynamics** IIT Kharagpur
  Machine Intelligence Term Project, Guide: Prof. Sudipta Mukhopadhayay *Fall 2017*
  - Acquired data for authentication using keystroke & mouse dynamics and extracted features from them.
  - Used Gaussian Mixture Model, SVM & Naive Bayes classifiers to differentiate the data of legal users & intruders.
  - Compared their performance & selected the best classifier to use as a second layer of user authentication.

AWARDS AND HONORS

- Honored with **Samsung Citizen Award** and **Spot Award** for excellent technical contribution in Samsung for the year 2020
- Secured All India Rank **487** in **JEE ADVANCED**-2014 (**secured 99.7 percentile**)
- Secured All India Rank **158** in **JEE MAINS**-2014 conducted by CBSE(**secured 99.99 percentile**)
- Secured All India Rank **102** in **Kishore Vaigyanik Protsahana Yojana**-2013 conducted by IISc, Bangalore and received scholarship for the same from Department of Science and Technology, Government of India
- Received **National Talent Search Examination** Scholarship from Ministry of Human Resource Development, India

RESPONSIBILITIES

- **Teaching Assistantship**: Department of Electronis and Electrical Communication Engg., IIT Kharagpur

  - Introduction to Electronics Lab: *Prof. Chetna Singhal & Prof. Shailendra Kumar Varshney* *2018*
  - Image Processing Lab: *Prof. Sudipta Mukhopadhyay* *2019*

- Mentor at a 4 week web development course organized by EduSpectrum for freshers of IIT Kharagpur *2016*

- Awarded the Best NSS Volunteer (National Service Scheme, under Ministry of Youth Affairs & Sports, India) for excellent service towards education and development in villages near IIT Kharagpur *2014-16*