Deepak Sridhar
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Work Experience

Computer Vision Research Engineer: May 2018-Aug 2022
Huawei Technologies Canada Co., Toronto, Ontario

- **Efficient Vision Transformers –** Designed and developed an efficient class of vision transformers that improves the accuracy while reducing the computational cost (ongoing).
- **3D hand Pose and Mesh estimation -** Designed a lightweight 3D hand joints and mesh estimation model that can run in real-time on low resource devices with competitive accuracy compared with large models. The architecture uses transformers as the learning head for joints and mesh prediction.
- **Hand Pose Project** - Led a small group of research engineers to develop a real-time hand pose estimation engine that was deployed for Huawei Education Tools applications in Huawei SmartLamp.
  - Designed the end-to-end model pipeline for detecting, classifying and localizing the hand joints.
  - Achieved the accuracy requirement (< 20 MPJPE), size (~5 MB) and speed requirements (>50 FPS) on mobile devices.
- **Smart TV Gesture Control Project** – Worked on the end-to-end model design and development of machine learning models that detect smart gestures such as swipe, drag and openhand gestures.
  - Developed a tiny hand detection and hand classification model that surpassed the accuracy requirements (> 95% precision and > 90% recall) and runs under 15 ms/image speed on Huawei mobile devices.
  - The models were successfully deployed in Huawei Smart TV launched in early 2020.
- **Spotlight Reel Project** - Developed a fast, accurate lightweight network for face detection model with orientation detection for detecting human faces in videos.
  - Developed a lightweight landmark localization model for localizing keypoints in a face that is used for alignment in face recognition.
  - The models were successfully deployed in Huawei P series smartphones that detects and retrieves video segments of different faces present in a video.
- **Research Projects**
  - **Face Recognition** – Developed a novel training method for face recognition systems that is extensible to all classification tasks. Achieved state-of-the-art results on IJB datasets at 10^{-6} false acceptance rate and competitive results on LFW, MS1MV2 datasets.
  - **Collaborative Inference** – Developed a novel architecture for training a single model and deploying it on multiple platforms with the capability of collaborating inference across devices.
  - **Video Retrieval and Grounding -** Collaborated with colleagues to develop a new efficient architecture for VCMR tasks.
  - **Action Detection** – Key contributor in achieving second position in ActivityNet Challenge 2021 Temporal Action Localization workshop held at CVPR'21. Published a paper in ICCV'21 based on a novel attention mechanism that achieves state-of-the-art performance on action detection benchmarks – ActivityNetv1.3 and THUMOS14 datasets.

Education

Master of Engineering, Electrical and Computer Engineering, Thesis **2016-2018**
McGill University, Montreal, Quebec **CGPA: 3.88/4**

Bachelor of Technology, Instrumentation and Control Engineering **2012 -2016**
National Institute of Technology Tiruchirappalli (NITT), India **CGPA: 9.6/10**

Skills

Programming: Python, Pytorch, TensorFlow, Caffe, MATLAB, C/C++, Embedded C, Java (Android), SQL

Software: Android Studio, Microsoft Excel, Access, Git, Pycharm, Arduino, LabView, MultiSim, Simulink

Certification: Deep Learning Specialization (DNN, ResNet, Inception), Machine Learning (SVM, PCA).

Publications

D Sridhar, N Quader, S Muralidharan, Y Li, P Dai, J Lu, **Class Semantics-based Attention for Action Detection**, ICCV 2021, 13739-13748

D Sridhar, H Michalska, **Non-asymptotic state and input estimation for smooth linear parameter varying systems**, 2018 IEEE Conference on Decision and Control (CDC), 686-693

D Sridhar, DP Ghoshal, H Michalska, **B-splines in joint parameter and state estimation in linear time-varying systems**, 2018 Annual American Control Conference (ACC), 3508-3513

US Patents Provisional/Filed

Devices and Methods for single or multi-user gesture detection using Computer Vision Feb 2022

Collaboratively developed a multi-user, multi-hand interaction system that for complex ROI selections and predicts touch with ToF sensors.

Systems and Methods for Video Retrieval and Grounding Nov 2021

Assisted in developing an efficient Video Corpus Moment Retrieval method that reduces the search time and the storage space for video retrieval and temporal grounding of videos in a large corpus of data.

Devices and Methods for Gesture based Selection using Machine Vision Aug 2021

Collaboratively developed a point reader system that uses two hands to implement complex interactions.

Methods and Devices for Training a Keypoint Estimation Network using cGAN-based Data Augmentation May 2021

Collaboratively developed a data augmentation method for 2D/3D hand pose estimation from RGB/depth images using a cGAN based iterative refinement.

Systems, Methods and Computer Media for Joint Attention Video Processing March 2021

Designed and developed a novel attention mechanism for video action detection tasks that advances the state-of-the-art methods using a novel joint attention block. Accepted to 2021 ICCV conference

Methods, Devices and Media providing an integrated Teacher-Student System March 2020

Invented a new architecture with novel modules for collaborative inference among multiple devices useful in Smart Home applications.

Projects/Research Experience

Non-asymptotic state and parameter estimation of linear time-varying systems: May–Dec 2017
Under Dr.Hannah Michalska, Associate Professor, McGill University.

- Developed a Multi-Class Classification in Python system to identify the nature of the time-varying coefficients of the LTV system using **Deep Neural Networks** with test accuracy of 81.2%.
- Developed a kernel representation for linear time-varying systems and employed B-spline functional approximation techniques in MATLAB to estimate the states and parameters of the LTV system for applications in target tracking.

Object Detection Android App - Capstone Project: Dec 2017
As a part of Deep Learning Udacity (Advanced) course.

- Fine-tuned the VGG-16 model to recognize Cats and Dogs and developed a CNN model (99.3 % test accuracy) for the MNIST dataset to recognize digits from 0-9 using TensorFlow.
- Retrained Inception v3, MobileNet models and evaluated the performance of these architectures against CPU and memory usage to obtain more efficient models for deployment on Android.
- Developed an **android app** which integrates the trained models with the android framework using TensorFlow to recognize Cats/Dogs and Digits from pictures taken from the app.
- Incorporated Text-to-Speech module to produce both text and speech output of the detected objects for better user experience. https://github.com/DeepakSridhar

Gesture Controlled Robotic Arm: January-April 2016
Under Dr.D.Ezhilarasi, Assistant Professor, NIT Trichy.

- In a team of 4, designed and built a "**Robotic arm that can mimic human actions**".
- Developed a model arm which captures the motion of human hand using sensors and transmits the information to the robotic arm through RF communication using ZigBee modules.
- Presented a demo and a comprehensive report on the literature review, methodology, results and future scope of the work to the project committee members.

TI Innovation Challenge Analog Design Contest: December 2014-January 2015
Under Dr.D.Sriram Kumar, Associate Professor, NIT Trichy.

- Worked on the project **"Wireless charging of mobile devices using ambient RF energy from mobile towers"** which involved charging mobile phones in easier and efficient manner using free RF energy available from Mobile Towers.
- Qualified to the quarterfinals of the competition.

Underwater Surveillance Robot (ARGO): February-March 2014
Presented at Sangam, Pragyan'14, an International Techno-Management Festival of NIT Trichy.

- In a team of 4, built the mechanical body of the semi-autonomous **"Underwater Surveillance Robot"** which was controlled externally by means of remote controller.
- Designed a signal conditioning circuit using relays to power the high-speed motors (propellers) using Arduino and interfaced pressure and temperature sensors to the robot.
- Programmed the ZigBee modules to effectively communicate and transmit the sensor values to

the central workstation up to a depth of 30 meters underwater.
- Received a special mention in a local newspaper for the project.

Internships

Mitacs Globalink Research Internship at McMaster University: May-July 2015
Under Dr. Qiyin Fang, Associate Professor, McMaster University.

- Worked on the project "**Optical Sensors for Smart Home Applications**" which involved developing an indoor patient tracking system using proximity sensors and RFID technology.
- Developed a system which was proven to be 15% energy efficient, low cost and robust.

Summer Research Internship at University of Hyderabad: May-June 2014
Under Dr.Samrat L. Sabat, Associate Professor, University of Hyderabad.

- In a team of 2, worked on the project **"Water Quality Monitoring System"**.
- Designed signal conditioning circuits for pH, Dissolved Oxygen, Turbidity and Conductivity sensors to test the quality of water by monitoring these parameters.
- Developed an **android app** that tracked objects (keys) embedded with Bluetooth and raised an alarm when it was out of 100m range.

Awards

- Awarded **Future Rising Star Award** that is chosen by peers to represent being a positive force | 2022
- Awarded **Outstanding Individual Award** for the year 2021 by Huawei Canada for leading a small team of research engineers to successfully deliver a project, achieving second position with key contributions in an international workshop, publishing top conference paper and multiple patents | 2021
- Awarded **Toronto RC Director Award** by Huawei Canada for contribution in research and delivery of key projects| 2021
- Awarded the **Globalink Graduate Fellowship** of value 15000 CAD by Mitacs Inc. | 2016-2017.
- Awarded the **Graduate Excellence Fellowship** of value 7500 CAD by McGill University | 2016-2017.
- Awarded merit certificate for being the top 10 percent scorers in the inter-level screening test of **Mathematics Olympiad** conducted by AMTI (Association of Mathematics Teachers of India) | 2012.
- Awarded trophies for **school topper** and **subject topper in all subjects** in AISSCE (All India Senior School Certificate Examination) 2012.
- Awarded **special merit certificate** for being among the **top 0.1 percent** of successful students of AISSE (All India Secondary School Examination) 2010.

Leadership and Volunteering

- **Vice President (Operations)** Electrical Engineering Graduate Students Society (EEGSS) Council, McGill University (2017-Present): Managed events such as Activity Night, EEGSS Holiday Lunch and conducted monthly meetings with EEGSS council members.
- **Head of Workshops** Sensors'16, a National Level Technical Symposium of ICE at NIT Trichy: Organized a series of Workshops on eclectic topics which include Electronics/Robotics, Design, and Software. (2015-2016).
- **International Student Services Buddy Volunteer** (McGill University): Facilitated smooth transition of new International Students to McGill (2017-Present).
- **National Service Scheme** (NSS): Conducted various fun events for under privileged school children from nearby localities (2012-2013).