Kuldeep S Kulkarni

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Research Interests

Computer Vision, Compressive Sensing, Machine Learning, Deep Learning

Skills

C, C++, Python, OpenCV, MATLAB

Education

- **Phd candidate** in Electrical Engineering with Arts, Media and Engg. (AME) concentration (Fall 2012-)(Overall graduate GPA : 3.78/4.0)
  Arizona State University, Tempe
- **Master of Science** in Electrical Engineering with Signal Processing and Communication as specialization (Fall 2010- Summer 2012)
  Arizona State University, Tempe
- **Bachelor of Technology** in Electrical and Electronics Engg. (2005-2009)
  National Institute of Technology Karnataka, Surathkal, India.

Publications

- P1: **Kuldeep Kulkarni**, Pavan Turaga, 'Recurrence Textures for Activity Recognition from compressive cameras', **International Conference on Image Processing**, 2012.
- P2: **Kuldeep Kulkarni**, Pavan Turaga, 'Reconstruction-Free Action Inference from compressive imagers', submitted to **IEEE Transactions on Pattern Analysis and Machine Intelligence.**
- P3: **Kuldeep Kulkarni**, Pavan Turaga, 'Real-time tracking from compressive cameras at 1% measurement rate', to be submitted **IEEE Transactions on Pattern Analysis and Machine Intelligence.**

Work Experience

- **Research Assistant**: Dept. of Electrial Engg. and Dept. of Arts, Media and Engg., Arizona State University, (Sept 2011- present)
  Inference problems in computer vision from compressive cameras - Persistent surveillance from camera networks results in huge amounts of data, often much more than what can be handled by the present day systems for tasks of inference, communication and storage. In such a scenario compressive cameras have emerged as a potential solution to deal with data deluge issues. Inference tasks in computer vision require high quality features which often require computationally expensive process of reconstruction. During my Phd, I have focused on tackling two important inference tasks, action recognition and object tracking directly from compressively sensed (CS) videos, at very high compression ratios of 100 or more.
  - **Action Recognition from CS videos:** [P1 and P2] Proposed a 3D smashed-filtering based framework approach to perform the action recognition from CS videos, directly from a small number of random measurements (typically 1% of the number of pixels in a frame of the video). We showed effective reconstruction-free action recognition and localization results on large scale and realistic datasets like UCF50 and HMDB51.
  - **Real-time tracking:** [P3] Developed a real-time object tracking framework which operates directly on a small number of compressive measurements (typically 1% of the number of pixels in a frame of the video). Specifically, we proposed specially designed measurement matrices which are tailored to facilitate real-time recovery of integral image estimates, just by minimal operation on the measured vector. Leveraging a wavelet based prior model for natural images, we formulate a nuclear norm minimization problem with second order conic constraints to optimally find the measurement matrix. We evaluate the utility of the integral image estimates by using them in conjunction with Haar-like feature based trackers, and show that there is negligible loss in tracking performance, even at 1% measurement rate.
- **Research Intern** at Bausch-Lomb, Rochester, NY (May-Aug 2013). Applied image processing techniques for segmentation of OCT images of contact lens.
- **Project Assistant**: Dept. of Instrumentation Engg and Applied Physics, Indian Institute of Science, (July 2009- March 2010)

- **Graduate Teaching Assistant:** for EEE 120- Simulation Lab for Digital Design Fundamentals for five semesters since Fall 2013.
- **Summer Intern:** Dept. of Electrical Engg., Indian Institute of Science, (May 2008-June 2008). Applied shape-context feature descriptor for online hand-writing recognition of two South-Indian languages, Kannada and Tamil.

Other Projects during Phd and Undergrad

- **What makes Federer so elegant ?:** [Phd] This project aimed to quantify the aesthetics of the play of a sportsman (the poise, the economy of their movement, the smoothness or the lack of it of the flow of their movement) in terms of what we called 'watchability' of the play. Given, a video clip (like youtube video) of a player playing a shot like cover drive in cricket, or forehand in tennis, we built a system which determined the 'watchability' scores of the different movements, the player makes while playing that particular shot. The movements can be stance, back-lift, and follow-through.
- **How do I dance ?:** [Phd] We built a real-time visualization feedback system for dancers using Kinect data of joint coordinates, as part of the 'Digital-Culture Showcase' organized every semester in AME department, ASU. The joint data collected from Kinect was used to determine in real time which of the 20 joints were being engaged most, and which of them were being dormant at any given point of time. For each individual joint, a temporally evolving self-similarity matrix based real-time visualization, depicting the dynamics of the joint's movements, was shown to the dancers. The visualizations were aimed at helping dancers fine-tune their dance steps and movements in real-time.
- **ALPHAVISION, a Real time character recognition Contest:** Won a MATLAB coding contest as an undergraduate student which involved developing a code which could take in live streaming of images (English alphabets falling from the top, projected on a screen, captured using a webcam), perform optical character recognition and perform selective deletion of the characters.
- **Image/Video Processing using Matlab to Control Paddle in Paddle and Ball Game:** Won a MATLAB coding contest in my undergrad college in which Paddle and Ball Game (similar to Pinball) running on a computer was projected on a white screen. A MATLAB algorithm (running on another computer) was written to capture this video using a webcam, then process the video frames captured to detect the ball, its location and estimate its trajectory. Signals were sent back to the computer running the game via the parallel Port to control the Paddle so that the ball does not fall.

Relevant coursework

Computer Vision and Pattern Analysis, Information Theory, Random Signal Theory, Multidimensional DSP, Detection and Estimation Theory, Digital Communication, Coding and Cryptography, Shape Analysis for Computer Vision and Graphics, Biomedical Image Processing, Wireless Communication, Nonlinear Control Systems, Design and Analysis of Algorithms, Transform Theory, Digital Signal Processing (Undergrad), Signals and Systems (Undergrad).

Academic Honours

- Secured a All-India position in top 5 percentile in IIT-JEE(Indian Institute of Technology-Joint Entrance Examination) Screening Examination attended by 1,71,118 candidates.
- Ranked 116th to Karnataka State and secured a All-India position in top 1.5 percentile in AIEEE(All India Engineering Entrance Exam) 2005 attended by 4,36,048 candidates.
- Ranked 30th in Karnataka State CET(Common Entrance Test) 2005 attended by 87,020 candidates.

Service

Reviewer for CVPR 2015, WACV 2015

References

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