

Himanshu Vajaria

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Objective

To obtain a full time position where I can apply my computer vision, image processing and pattern recognition skills to solve challenging problems.

Education

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|--------------|---|-----------------------------|
| Ph.D. | Computer Science and Engineering, University of South Florida, Tampa, FL
Advisors: Prof. Ranga Kasturi, Prof. Sudeep Sarkar
GPA – 3.96/4.0 | 01/04 - 08/08
(expected) |
| M.S. | Electrical Engineering, Pennsylvania State University, University Park, PA
Advisors: Prof. Ranga Kasturi, Prof. Octavia Camps
GPA – 3.4/4.0 | 08/01 – 12/03 |
| B.S. | Electronics and Telecommunication, Mumbai University, Mumbai, India
GPA – 3.8/4.0 (estimated)
Ranked in top 10% of graduating class. | 08/97 – 05/01 |

Technical Skills

Programming:	C, C++, Matlab, Shell Scripting, Visual Basic
Operating Systems:	UNIX, Linux, Windows
Databases:	MS Access
Web:	HTML, Photoshop, Javascript, Flash

Research Interests

- Pattern Recognition
- Data Mining
- Computer Vision
- Image Processing
- Remote Sensing
- Document Image Analysis
- Multimedia Indexing
- Content Based Retrieval
- Biometrics
- Emotion recognition
- Object detection and tracking
- 3D reconstruction

Research Experience

Computer Science and Engineering, University of South Florida (USF) 08/03 - present
Research assistant, Advisors: Prof. Ranga Kasturi, Prof. Sudeep Sarkar, Prof. Ravi Sankar

Multimedia analysis

- Devised a novel algorithm to perform view invariant event recognition by using eigenvectors to represent motion and HMMs to capture temporal transitions.
- Developed a system to determine “who spoke when?” in an audio recording using a graph spectral clustering framework for grouping short speech segments. Proposed method compares favorably to existing approaches in terms of speed and accuracy.
- Developed a system to simultaneously determine who spoke when and locate the current speaker in meetings recorded using only a single camera and a single microphone.
- Developed a query by example framework to query meeting archives.
- Implementation: C++ using OpenCV and Matlab on Windows

Multi-biometric recognition

- Analyzed performance of various biometric systems for indoor and outdoor recognition tasks.
- Studied the effect of indoor-outdoor variations on the verification performance of individual and multimodal systems.
- Evaluated various normalization and fusion schemes and compared the performance of classical algorithms to commercial systems.
- Demonstrated application of graph spectral clustering for database indexing.
- Proposed a likelihood ratio based recognition system that employs individual-specific score models. The system implicitly performs user-specific modality weighting and score normalization.
- Implementation: Matlab and C++ on Windows

Google, Mountain View, California
Research Intern, Mentor: Dr. **Ullas Gargi**

08/07 – 11/07

Motion based video similarity

The hypothesis behind this research project was that videos with similar content also have similar motion characteristics. Thus, incorporating motion cues in the video similarity framework would allow the system to refine the “related videos” returned by keyword based similarity search.

- Devised a spatio-temporal algorithm to filter noisy optic flow vectors.
- Defined a set of global and spatially sensitive features to characterize the motion in each frame.
- Identified key time-scales and computed wavelet coefficients to characterize the motion per shot.
- Defined a video-video similarity metric based on shot-shot distances.
- Conducted preliminary investigations on motion-based shot boundary detection.
- Experiments on a set of 10,000 videos showed promising results for video clustering.
- Implementation: C++ on Linux

Florida Environmental Research Institute, (FERI) Tampa, Florida
Research intern, Advisors: Dr. **David Kohler**, **Paul Bissett**

07/06 – 12/06

FERI specializes in flying over sea to obtain high resolution images. Two different cameras are employed, one is a high spatial resolution (22 mega pixel) RGB camera and the other is a high spectral resolution (128 wavelengths) camera. The data collected is used in various applications such as prediction of Red Tide, mapping ocean fauna and creating bathymetry maps.

Image Classification

- Modified the fuzzy C-means algorithm to incorporate neighborhood information leading to a smoother classification map.
- Evaluated different features, transformations, distances, classifiers and classifier fusion techniques for classifying image regions.

Image fusion for super-resolution

- Developed an algorithm to combine a high spatial resolution and a high spectral resolution image into a high-spatial and high-spectral resolution image. Proposed approach performs better than commercial software.
- Implementation: IDL and Matlab on Windows

Computer Science and Engineering, Penn State University (PSU)
Research Assistant, Advisors: Prof. **Ranga Kasturi**, Prof. **Octavia Camps**

06/02 – 08/03

Obstacle Detection for Collision Avoidance Using Infrared Images

This **NASA** project required a real-time system to detect flying obstacles in the path of an aircraft.

- Evaluated various filters for noise removal, feature extraction and tracking.

- Proposed a modified optic flow based method for ego-motion compensation.
- Developed an object detection module based on a combination of motion characteristics and template matching.
- Implementation: C on Unix

Cognitive Psychology Lab, Penn State University (PSU)
Research Assistant, Advisors: Prof. Richard Gilmore

06/02 – 08/02

Postural sway of infants in response to a simulated oscillation environment

An oscillatory motion was simulated at different frequencies on a large screen. Flock of bird sensors attached to the head, shoulder and hip measured the response of major joints and a force platform tracked the center of weight as the children swayed in response to the oscillations.

- Performed the hardware setup, developed simulations and collected data.
- Analyzed frequency response obtained from various sensors.
- Designed a simulation to study gaze response in infants.
- Implementation: Shell scripts, C++ on Unix

Sample Class Projects

- **Stereo camera calibration:** Studied the effect of varying number of calibration images and distribution of calibration points on the calibration accuracy.
- **Person and Vehicle Detection and Tracking:** Experimented with different background segmentation techniques and the CONDENSATION and Kalman filter trackers.
- **Skin Color Detection:** Experimented with various color-spaces and different histogram matching techniques to detect skin color.
- **Object recognition:** Compared Principal Component Analysis (PCA) and Independent Component Analysis (ICA) for object classification under varying pose and illumination.
- **Unsupervised learning** and classification of the Iris database using Maximum Likelihood Estimation. Studied the effects of initialization and the number of iterations on the classification performance.
- **Back Propagation Neural Network:** Implemented a neural network to identify diabetes patients based on 13 attributes. Studied the effects of network parameters on identification accuracy.
- **Document Image Analysis:** Implemented various algorithms for image segmentation, text/graphics detection, skew detection and correction. The developed modules were applied as part of a course project to extract information from Business cards and Checks.

Publications

H. Vajaria, S. Sarkar, R. Kasturi, "Clip Retrieval using Multi-modal Biometrics in Meeting Archives", submitted to International Conference on Pattern Recognition, 2008.

H. Vajaria, S. Sarkar, R. Kasturi, "Single camera, single microphone localization in Meeting Videos", submitted to IEEE Transactions on Circuits and Systems for Video Technology.

H. Vajaria, T. Islam, P. Mohanty, S. Sarkar, R. Sankar, R. Kasturi, "Indoor-Outdoor Face and Voice Fusion", Pattern Recognition Letters, Volume 28, Issue 12, September 2007.

H. Vajaria, T. Islam, S. Sarkar, R. Sankar, R. Kasturi, "Audio Segmentation and Speaker Localization in Meeting Videos", in International Conference on Pattern Recognition, 2006 (**won best student paper award**)

H. Vajaria, T. Islam, P. Mohanty, S. Sarkar, R. Sankar, R. Kasturi, "An outdoor biometric system: evaluation of normalization and fusion schemes for face and voice", in SPIE Defense and Security Symposium April 2006

H. Vajaria, R. Kasturi, O. Camps, "Algorithms for Obstacle Detection for Collision Avoidance Using Infrared Images", NASA CASI Technical Report, December 15, 2003.

R. Gilmore, M., Dahlin, **H. Vajaria**, S. Slobounov, H. Chiang, E. Slobounov, G. Otto, "Development of perception-action coupling in early childhood", Cognitive Neuroscience Society Annual Conference, Atlanta, GA, USA. March 2002.

Coursework

Pattern Recognition, Data Mining, Neural Networks, Computer Vision, 3-D Data from Images, Image Processing, Biomedical Image Processing, Document Image Analysis, Computer Architecture, Operating Systems, Computer Algorithms, Linear Statistical Methods, Multivariate Analysis, Stochastic Processes and Estimation, Digital Communications, Biomedical Instrumentation, Mammalian Physiology.

Professional Memberships

- **Vice President**, IEEE-CS Student chapter at the University of South Florida
- **Committee Member**, Defense and Security Symposium, SPIE conference OR36
- **Reviewer**: Pattern Recognition, Pattern Recognition Letters

Awards and Achievements

- Best student paper award, International Conference on Pattern Recognition (2006)
- Scored 99% on the Graduate Record Examination (GRE) (2000)
- Best student award, Giants group of Bombay (1994)
- Mathematics Olympiad Representative, St. Anne's High School (1993)

Personal Information

Citizenship: India
Visa Status: International student (F1)
Data of Birth: 03/25/1980
Gender: Male

References

Available on request.