Yash Sanjay Bhalgat

Curriculum Vitae *Last updated: November 14, 2016*

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Education

Indian Institute of Technology, Bombay, India **2013-2017 (expected)**
Bachelor of Technology, Department of Electrical Engineering

- **Honors** in Electrical Engineering, **Minor** in Computer Science
- **Thesis**: *Scattering Convolution Networks based Latent Orientation field estimation*
- **Advisor**: Prof. Vikram Gadre
- **GPA**: 9.44/10

Research Interests Computer Vision, Machine Learning, Pattern Recognition. I am also passionate about Computing, Robotics, Biometrics and Astronomy.

Objective A graduate position in the stated areas of research interest, with emphasis on working in Computer Vision. Developing a research aptitude and striving for proficiency in preparation for a highly skilled professional position in academia or industry

Research

Publications **Yash Bhalgat**, Mandar Kulkarni, Shirish Karande, Sachin Lodha,
Stamp Processing with Examplar Features, *12th IAPR workshop on Document Analysis and Systems (DAS), Greece, 2016.* Paper here

Research Experience

Joint multi-modal representations for e-commerce catalog search by visual attributes
IBM Research, Bangalore, India
Guide: Dr. Vikas Raykar and Amrita Saha **Summer '16**

Used CorrNets, an autoencoder based architecture, to learn the joint representation for both the image and caption such that the two reps are embedded in the same space maximizing their correlation. Showed that these joint multi-modal representations are a viable alternative for searching large fashion catalogues without manual tagging. Presented as a poster in the seminar at IBM Research, Bangalore, India.

Object recognition in document images using semi-supervised Deep Learning
Tata Research Design and Development Center, Pune, India
Guide: Dr. Shirish Karande and Mandar Kulkarni **Dec '15**

With specific recognition to stamp detection - segmentation, proposed a shape-based approach and a ranking algorithm for learning the 1^{st} layer filters of our architecture. We also proposed a scheme to rank and choose the subset. The approach performs better than many competing approaches: K-SVD, Gabor filters and other deep learning techniques. Stamp detection accuracy of 94% and segmentation IoU (Intersection over Union) of 74.81%. [arXiv]

Scattering Conv Networks based Latent Orientation Field Estimation
TI-Digital Signal Processing Lab, IIT Bombay, Mumbai, India
Guide: Prof. Vikram Gadre **Fall '13 - Ongoing**

Initially targeted for the FVC-ongoing competition, I am pursuing this as my undergraduate thesis. Estimating orientation fields is very challenging in latent fingerprints (i.e., impressions lifted typically at crime scenes) due to complex background noise. Inspired by previous approaches using patch dictionary-based enhancement, I proposed employing Mallat's group invariant scattering approach to tackle this problem. Combining several ideas such as iterative scaling-based sparse dictionary representation, it is viewed as a texture disambiguation problem. Work with touchless fingerprints is in writing as a paper to the Pattern Recognition Letters journal.

Indoor Navigation System - Pedometry

Focus Analytics, Mumbai, India

Guide: Sudin Kadam and Manoj Gudi **Dec '14**

The Global Positioning System fails its purpose in small areas like malls and domestic airports. To tackle this problem, I developed a pedometry-based indoor navigation system with a final accuracy of **1-1.5 meters**. Work involved processing data from mobile phone "inertial" sensors, noise reduction, developing various pedometry algorithms - TRIAD algorithm for heading estimation, DTW (Dynamic Time Warping) for step-frequency estimation, etc. - and testing them on real-time data.

Technical Experience

Development of SCILAB Image Processing Toolbox

FOSSEE, IIT Bombay **Dec '15**

Open-source software SCILAB has an underdeveloped functionality in the Image Processing (IP) toolbox as compared to MATLAB. I developed 10 moderate and hard-level functions (in Python and C++) - geometrical transformations, image registration, filtering operations, etc. These will added to the newest version in Feb, 2016.

Mars Society - University Rover Challenge

Navigation System Design of Autonomous Mars Rover, IIT Bombay **Aug '14-Mar '15**

Worked in the Navigation & Vision subsystem of the project, aimed at building a semi-autonomous prototype of the Mars rover. I used the Robotic Operating System (ROS) to analyse the visual input from on-board stereo cameras for guiding the rover to reach the destination using algorithms like the A-star algorithm. Our rover entered the University Rover Challenge, Utah.

Software module development using CAD modelling engine

Infurnia, Mumbai **Summer '15**

Infurnia is a furniture e-commerce startup in Mumbai. I created a range of "constraint-modules" and modified functions in FreeCAD for direct use without affecting backward compatibility. Extensively using classes, multiple and multilevel inheritance, etc. in Python. It was a great experience working in a StartUp, getting hands-on experience handling the complete code-base.

Presentations

- '*Stamp Processing with Examplar Features*', 12th IAPR workshop on Document Analysis Systems (DAS), Santorini, Greece (April '16)
- '*Emotion from Speech*', TeQIP Seminar Poster Presentation, IIT Bombay, India (March '16)
- '*How deep neural networks can be taught to classify images?*', Blog, Electronics Club, IIT Bombay link

Academic Experience and Achievements

Scholastic Achievements

- Awarded Cargill Global Scholarship 2014-15 and selected in the 10-member Indian cohort to represent at the global seminar in Minneapolis, USA.
- Secured (All India Rank) AIR 12 in IITJEE-mains 2013 among 1.5 million students
- Secured AIR 155 in JEE-advanced 2013 examination among 0.15 million candidates
- Secured AIR 60 in KVPY Scholarship Examination 2013 among 0.2 million candidates, awarded by the Department of Science and Technology, Govt. of India
- Selected for Orientation-Cum-Selection camp for and International Astronomy Olympiad (IAO-2013), in top 30 among 45 thousand students
- Also among top 300 of the nation to compete in INPhO (Indian National Physics Olympiad), INChO (Chemistry) in 2013 and INMO (Indian National Mathematics Olympiad) in 2011.
- Winner of IMATATHON - Image Processing Hackathon held by Electronics Club, IIT Bombay

Key Course Projects

Object Recognition using Convolutional Neural Networks
Guide: Prof. Suyash Awate (CS-663 Digital Image Processing) **Fall '15**
Implemented a 4-layer neural network from scratch - convolution, subsampling, pooling and loss layers. Data preprocessing using ZCA-whitening. Tested results on MNIST, CIFAR-10 and STL-10 datasets. Detailed code and report here: [github-link]

Computer Vision and Image Processing algorithms acceleration using CUDA
High Performance Scientific Computing (ME - 766) [github-link]
Guide: Prof. S. Gopalakrishnan **Spring '16**
Most image processing and computer vision algorithms involve processing blocks of images. These properties of image data make it a natural choice to parallelize them and exploit the SIMD nature of the algorithms. Implemented 8 IP algorithms, depth retreival from stereovision and optical flow for high video rates in CUDA.

Real Time Onset-detection in Speech Signals
Instructor: Prof. Rajababu (EE-779 Advanced Signal Processing) **Fall '16**
In music, onset detection is useful for beat-syncronization, temporal segmentation of signals, etc. Used a Linear Prediction + sinusoidal modelling to estimate Onset Detection Functions (ODF) achieving final prec of 78% on recall 69% on *Modal* database.

Sarcasm detection in sentences
Guide: Prof. Ganesh Ramakrishnan (CS-725 ML) [github-link] **Fall '16**
We explored 3 kinds of features: Lexical, Pragmatic and Linguistic Incongruity. Ran the feature selection algorithms using a Gini Impurity index and used a Neural Network (1 hidden layer) for classifying sarcastic and non-sarcastic texts.

Segmentation of MRI images using Expectation Maximization
Guide: Prof. Navin Kaneja (EE-638 Estimation and Identification) **Fall '16**
3 brain labels - white matter, gray matter and CSF modelled using a Gaussian Mixture Model and Markov Random Field based smoothness prior was used on the pixels. 2-step EM algo was used to solve the GMM and assign class-probabilities to each pixel.

Relevant Courses

Computer Vision, Wavelets, Machine Learning, High Performance Scientific Computing, Digital Image Processing, Matrix Computations, Design and Analysis of Algorithms, Advanced Topics in Signal Processing, Estimation and Identification, VLSI CAD, Probability and Data Analysis, Network Theory, Control Theory, Complex Analysis, Microprocessors, Logic in Computer Science

Technical Skills

- *Languages:* C/C++, Python, Bash, Java, Verilog, R
- *Packages:* Theano, TensorFlow, OpenCV, Praat, CUDA, (basic) MPI, MATLAB, PyEDA
- *Operating System:* ROS (Robot Operating System), GNU/Linux, Windows

Extracurricular Activities

Music

- Awarded a "Visharad"(Bachelors degree in Music) in Tabla by Akhil Bhartiya Gandharva Mahavidyalaya in 2011
- Completed 5 Grades/Levels in Piano approved by the Trinity College of Music, London
- Lead Tabla player of musical band Saptak and have won Battle of the Bands, IIT Bombay as the best musical group. Performed in events like ROOTS, Surbahaar which see huge audience from students, faculty and employees of IIT Bombay

Mentorship

Undergrad Teaching Assistant - Quantum Mechanics *Fall '14, Summer '15*
Assisted and guided a batch of 50 first year students as a Tutor in this course for 2 semesters. Besides weekly sessions, setting and evaluating of quizzes, conducted extra sessions for students needing special attention improve overall performance.