

Yash Sanjay Bhalgat

Curriculum Vitae

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CONTACT INFORMATION	yashbhalgat@iitb.ac.in	(+91)9892923181	https://yashbhalgat.github.io/
EDUCATION	Indian Institute of Technology, Bombay, India 2013-2017 (expected) <i>Bachelor of Technology, Department of Electrical Engineering</i> <ul style="list-style-type: none">• Honors in Electrical Engineering, Minor in Computer Science• Thesis: <i>Scattering Wavelets Network based Latent Fingerprint Enhancement</i>• Advisor: Prof. Vikram Gadre• GPA: 9.44/10		
RESEARCH INTERESTS	Computer Vision, Machine Learning, Pattern Recognition. I am also passionate about Robotics, Biometrics and Astronomy.		

Research

PUBLICATIONS	Yash Bhalgat , Mandar Kulkarni, Shirish Karande, Sachin Lodha, Stamp Processing with Exemplar Features, <i>12th IAPR workshop on Document Analysis and Systems (DAS)</i> , Greece, 2016. Paper here		
RESEARCH EXPERIENCE	Joint multi-modal representations for e-commerce catalog search by visual attributes IBM Research, Bangalore, India <i>Guide: Dr. Vikas Raykar and Amrita Saha</i> 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 <i>Guide: Dr. Shirish Karande and Mandar Kulkarni</i> 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 Wavelets Network based Latent Fingerprint Enhancement TI-Digital Signal Processing Lab, IIT Bombay, Mumbai, India <i>Guide: Prof. Vikram Gadre</i> 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 on fingerprint classification using ScatNets and other on touchless fingerprints are in writing as manuscripts to the Pattern Recognition Letters journal.		

PRESENTATIONS AND TALKS

- ‘*Scattering Wavelets Network based Latent Fingerprint Enhancement*’, Research Scholars Conclave, College of Engineering, Pune (COEP) (March ’17)
- ‘*Stamp Processing with Exemplar 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](#)

TECHNICAL EXPERIENCE

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. 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, Dynamic Time Warping for step-frequency estimation, testing them on real-time data.

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.

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 be added to the newest version in Feb, 2016.

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.

Academic Experience and Achievements

SCHOLASTIC ACHIEVEMENTS

- Secured All India Rank 12 in IITJEE-Mains 2013 exam among 1.5 million students
- Secured All India Rank 155 in IITJEE-Advanced 2013 exam 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
- Featured in National Top 30 for the International Astronomy Olympiad, 2013 among 45 thousand students and selected for Orientation-Cum-Selection camp for IAO-2013
- 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.
- Awarded Cargill Global Scholarship 2014-15 and selected in the 10-member Indian cohort to represent at the global seminar in Minneapolis, USA in 2016
- 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 retrieval 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-synchronization, 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.

BLOG

Authored a blog for Electronics Club, IIT Bombay on “How can deep neural networks be trained to classify images?” [link](#)
