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Karttikeya Mangalam

Senior Undergraduate, Electrical Engineering, IIT Kanpur

Education

Indian Institute of Technology, Kanpur, India
Major in Electrical Engineering with
Minor in Artificial Intelligence *Aug.'14 - Jun.'18 (Expected)*
GPA: 9.4/10 (6 Semesters)

Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland
Semester Exchange in Computer Science (One Semester) *Sept.'17 - Feb.'18 (Expected)*
Ongoing

Paramount Academy, Muzaffarpur, India
All India Senior School Certificate Examination, Class XII *May '12 - Apr.'14*
Percentage: 94.6%

D.A.V. Public School, Muzaffarpur, India
All India Senior School Certificate Examination, Class X *April 2012*
GPA: 10/10

Research Interests

Computer Vision, Deep Learning, Machine Learning, Image Processing

Publications

Karttikeya Mangalam, K S Venkatesh "Bitwise Operations of Cellular Automaton on Gray-scale Images" Published at *28th Irish Signals and Systems Conference* (ISSC'17), Ireland

Karttikeya Mangalam, Tanaya Guha "Using Spontaneity of Speech to Improve Emotion Recognition" Submitted to *IEEE Signal Processing Letters*

Takuma Yagi, **Karttikeya Mangalam**, Ryo Yonetani, Yoichi Sato 'First-Person Human Trajectory Prediction" Submitted to *Computer Vision and Pattern Recognition 2018* (CVPR'18)

Awards & Achievements

All India Rank 1 in National Science Talent Search Examination-2011 out of 500,000 students

Selected as an **Indian National Mathematical Olympiad Awardee**, awarded to only 30 students nationwide annually *'for demonstrating extraordinary talent in pre-college mathematics'*

Received **Summer Undergraduate Research Grant** for Excellence 2016 by IIT Kanpur
Received **Academic Excellence Award**, awarded to Top 5% students in IIT Kanpur

1st State Rank in Regional Mathematics Olympiad-2013 out of 10,000 students
1st State Rank in 5th SOF International Mathematics Olympiad 2012
1st State Rank in both First & Second Round of NTSE-2010 out of 30,000 students
1st State Rank in National Level Science Talent Search Examination -2011

Top 1% Nationwide out of 37,000 enrolled in National Standard Examination in Physics
Top 1% Nationwide in National Standard Examination in Junior Science 2010
Top 1% Nationwide out of more than a million students in AISSCE 2014

99.97 percentile in Joint Entrance Examination (IIT-JEE) 2014 among 1.5 million students

Recipient of **Honda Young Engineer & Scientist's (Y-E-S) Fellowship** 2017, awarded to **14** undergraduates nationally *for appreciating their excellent undergraduate research work*
Received a grant of **$10,000** through the YES+ program for summer research internship

Selected as a National Talent Search awardee in 2010 bestowed by MHRD to **500 among over 300,000** students nationwide *to identify students with high intellect and academic talent*

Research Projects

All research papers are uploaded on the homepage & arXiv

First-Person Human Trajectory Prediction

Summer Internship, Prof. Yoichi Sato, CV Lab, University of Tokyo *May '17 - Nov.'17*

- In collaboration with a master's student, devised a *Deep Multi-stream Convolution-Deconvolution Architecture* for estimating future pedestrians' positions in a first person viewpoint video
- Incorporated several key observations as salient features to improve performance such as perceived visual scale of humans, ego-motion of the camera wearer and human pose information for pedestrians - Investigated a number of state of the art models for Pose Estimation, Segmentation, Depth Estimation, Social Interaction Modeling and Path prediction techniques centered around Human Affective CV
- Tweaked and tested various Deep Convolutional and Sequential architectures
- Collaborated to *record and benchmark a new dataset* for locomotion research in first person vision
- Results are submitted to **Computer Vision and Pattern Recognition** (CVPR) 2018

Learning Spontaneity to Improve Emotion Recogntion in Speech

Prof. Tanaya Guha, Multimedia & Signal Processing Lab, IIT Kanpur *Jan.'17 - Nov.'17*

- Proposed two different *Multi Task Learning based SVM frameworks* (Hierarchical and Joint) for emotion recognition in speech utilizing the spontaneity information
- Identified several novel features for the task of spontaneity (planned or improvised) detection such as context and delta values through feature ablation experiments one the USC IEMOCAP database
- Outperformed the baseline by **12% in positive emotion** identification and by 3% overall
- Paper on the findings is currently submitted for review to the journal **Signal Processing Letters**

Binary Image Recombination after Bitwise Operations Of Cellular Automaton

SURGE Research Internship, Prof. K S Venkatesh, CV Lab, IIT Kanpur *May '16 - May '17*

- Designed a novel algorithm to extend the use of Cellular Automaton of Image Processing tasks
- Improved upon the performance of *Median filtering algorithm* on denoising **Salt & Pepper noise by 5-7 %** with minimal space-time overheads using the proposed algorithm
- Results of the project are published in **Irish Signals and System Conference 2017**, Ireland.

Distillation of Fully Convolutional Networks with Residual Connections

Semester Research Project, Dr. Mathieu Salzamann, CV Lab, EPFL *Oct.'17 - Present*

- Implemented the **U-net architecture** with 2D and 3D convolutional layers in Pytorch
- Tested and compared a number of different models, varying the channel layer depth, softmax temperature, kernel size, architecture depth and optimization parameters.
- Proposed novel distillation methods based on work by Hinton et al. and successfully performed the knowledge transfer to a much **smaller model with just 3% of the original parameters**

Internship & Relevant Projects

Generative Visual Manipulation using Manifold learning

EE558 - Network tour of Data Science, EPFL *Sept.'17 - Present*

- Devised a pipeline chaining SoTA methods for Manifold learning, sampling along the learned manifold and reconstructing through FCN regressors to generate a 'new' face image using the FERRET dataset
- Improved appearance of the generated image by incorporating a GAN learnt latent space

These projects are the selected based on relevance.

An exhaustive list of projects along with the project reports and code is available on the homepage.

Prominent Features in Product Advertisements
CS401 - Applied Data Analysis, Prof. Robert West, EPFL *Sept.'17 - Present*

- In a team of three, investigated the Amazon Review dataset to identify influential textual and visual features of the product's advertisement that affect consumer reviews
- Employed several statistical hypothesis testing methods aided by CV and NLP techniques
- Developed a 'data story' website to present results : https://adamazon.github.io/

Online Recommendation under Log-normal likelihood
CS773A - Online Learning & Optimization, Prof. Purushottam Kar, IITK *Jan.'17 - May '17*

- Analyzed classical SGD-based matrix completion recommendation approaches like Jin's algorithm
- Designed an online recommendation scheme under the case of Log-normal likelihood models for a given reward function, as well as it's offline variants for matrix completion

Hybrid Recommender Systems using feature selection by Markov Blanket
Busigence Technologies, Machine Learning Internship *December 2016*

- Designed a Probabilistic Graphical Model Based pipeline to select features using an improved Incremental Association Markov Blanket (IAMB) algorithm
- Devised a hybrid recommender system using Restricted Boltzmann Machine based Collaborative Filtering and applied it on e-commerce and retail domain

Emotion Recognition from Static Human faces
CS771A - Machine Learning, Prof. Piyush Rai, IITK *Aug.'16 - Dec.'16*

- Employed Google Cloud Vision API for facial feature extraction such as pixel locations of keypoints etc. on Emotion Recognition in the Wild challenge 2016 database
- Trained Convolutional Models using Pytorch and benchmarked against state of the art methods

Automated Modeling for Course Recommendation (C.R.A.M)
Google DevFest 2016 *October 2016*

-In a team of three, developed a web-app to recommend next semester courses to IITK students using model trained from alumni career paths and curriculum at IITK
- **Stood Overall best winner** (application + business plan) amongst more than 50 competing teams

Computer Vision Subsystem, Varun
Autonomous Underwater Vehicle (AUV), Robotics Club, IITK *Sept.'14 - Dec.'15*

- Implemented various computer vision algorithms for object detection and line following in python and OpenCV to develop an AUV capable of maneuvering autonomously underwater
- Integrated the computer vision system with onboard odroid and turbine actuators for 360 maneuver

Solutions To Non-Causal Difference Equations
Prof. KS Venkatesh, CV Lab, IITK *Dec.'15 - Jan.'16*

- Designed a novel algorithm for finding solutions to Non-Causal difference equations efficiently
- Mapped the discrete problem to an equivalent problem in differential equations and then, sampled in continuous domain to obtain the discrete domain results. Benchmarked with existing algorithms

Magneto, Gesture Controlled Remote Bot
Technical Festival, IIT Bombay *Dec.'15 - Jan.'16*

- Designed a bot along capable of picking up and throwing a ball about a distance of two meters
- Fabricated a hand glove capable of detecting a total of 9 gestures using accelerometer and flex sensors for hand movements and finger bents and transmitting them over internet to the bot

Computer Skills

Languages: Python, R, C/C++ , Mathematica, MATLAB
Packages(ML): Scikit-learn, Scikit-Multilearn, Weka, Matlab ML Package, CatBoost, XGBoost
Frameworks(CV/DL): OpenCV, Pillow, Pytorch, Tensorflow, Keras, Chainer, Theano

Relevant Coursework

Mathematics: Linear Algebra, Probability and Statistics, Mathematics of Data* (Stochastic Optimization), Discrete Opimization (Coursera), Calculus - II, Topics in Learning Theory†

Machine Learning: Machine Learning Techniques, Online Learning and Optimization, Machine Learning (Coursera), Neural Networks (Coursera), Machine Learning Programming*

Computer Vision: Visual Recognition**, Computer Vision Techniques**, Image Processing**, Image processing I*, Advanced Image Processing†, Deep Learning (deeplearning.ai)

Data Science: Applied Data Science*, A Network Tour Of Data Science*

** indicates ongoing at EPFL † indicates to be taken in Spring'18 ** indicates audited at IITK*

Voluntary Work

Core Team Operations
Counselling Service, IIT Kanpur — *Jan.'16 - Jan.'17*

- In a team of 10, organized a 6-day long Orientation Program on behalf of IIT Kanpur to welcome the batch of 2016 and ensure a smooth transition to college life
- Led a team of 137 students guides, to carry out the admission procedures for the new batch such as academic registration, course allotment and biometric affiliation
- Organized institute-level remedial sessions aimed at providing help to the academically weak students

Webmaster, Counselling Service
Counselling Service, IIT Kanpur — *Jan.'16 - Present*

- Developed and maintained Counselling Service's website : http://www.iitk.ac.in/counsel/
- Overhauled the institute's freshman forum; aimed for providing support during admission counselling

Academic Mentor
Counselling Service, IIT Kanpur — *Feb.'15 - Jan.'16*

Assisted academically weak students in their freshman year undergraduate courses through institute-level remedial revision lectures and one-on-one doubt clearing sessions

Team Leader, Operations
Alumni Contact Program, IIT Kanpur — *Aug.'14 - Feb.'15*

- Reached out to alumni for organizing batch re-unions & institute's almuni donation program
- Organized over 25 information sessions for aspiring undergraduates from successful alumni in various industry for career guidance and planning

Hobbies

Machine Learning Hackathons, Kaggle Challenges and various conference challenges such as NIPS 2017 Competition Track - Adversarial Attacks and Defences

Philosophical debates and discussions on scientific methods and major canons such as Nihilism, Atheism and Logical Positivism