Bishal **Ghosh**

System Engineer · Social Robotics Researcher

B.Tech Mechanical Engineering, IIT Ropar

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"If you can dream it you can do it"- Walt Disney.

Education

B.Tech. in Mechanical Engineering — *8.42/10*

Indian Institute of Technology Ropar — *Jul. 2014 - Jun 2018*

XII Grade, CBSE-A.I.S.S.C.E — *92.2/100*

Kendriya Vidyalaya No.1 Agra — *2014*

X Grade, CBSE-S.S.E — *10.0/10.0*

Kendriya Vidyalaya No.1 Agra — *2012*

M.S. in System Science and Applied Informatics — *3.27/4.0*

Osaka University, Japan — *Withdrawn*

Research Interest

Cognitive Development Robotics, Social Robot, Reinforcement Learning, Human-Robot Interaction

Initially, my research interest was in Human-like interaction behaviour generation for robots. During my further studies, I came to understand theories by Dr B.F Skinner, Pavalov, Vygotsky and later the developmental aspect of co-speech gesture. Now I am currently focused on Cognitive Developmental Robotics to understand the process of development of instinctual/subconscious behaviour of children. Currently I am closely following cognitive architecture ACT-R, RL agent Agent-57 by deepmind and the book "From Babies to Robots"- Angelo Cangelosi, Matthew Schlesinger

Patents and Conferences

Domain Adaptation and Unsupervised Multimodal Based Topic Modelling Techniques for Engagement Estimation in the Wild (14th IEEE International Conference on Automatic Face & Gesture Recognition (FG 2019)) ieee — *Lille, France*

A. Kaur, B Ghosh, N Singh, Dr. A. Dhall — *2019/05/14*

- Proposed domain adaptation based latent topic learning model for engagement estimation. We compared the performance of different clustering algorithm for topic learning and analyzed the role of correlation loss function as a regularizer.

Speech-Gesture Mapping and engagement evaluation in Human Robot Interaction (28th IEEE International Conference on Robot & Human Interactive Communication (Ro-MAN 2019)) ieee — *Delhi, India*

B. Ghosh, Dr. A. Dhall, Dr. E. Singla — *Oral Presentation*

- Proposed an end-to-end system that identifies dominant gestures in an unsupervised way, maps them to speech and adapts speech during performance based on audience's response.

Stapling device with multi-tier force multiplication mechanism for binding hard materials (Indian Patent Office, Temp ID - 3961/DEL/2015) — *Delhi, India*

Dr. P Sarkar, B Ghosh, M Sarin, A Mamata, D P S Tomar — *Dec. 2015*

- Introdced multi-tier stapling mechanism, which enhances the end load using lever and gear combination.

Work Experience

Graduate RA, LASII LAB(Dr. Abhinav Dhall)

IIT Ropar, India

RESEARCHER FOR <FACE ANTI-SPOOFING>

Sep. 2018 - Present

- Objective :Imposter detection using smartphone face login
- Objective :Engagement analysis for MOOC-sessions with attention networks
- Objective :Empathy valence score estimation for story-telling session.

Undergraduate Research Intern, ROBITA LAB(Prof. G C Nandi)

IIIT Allahabad, India

RESEARCHER FOR <OBJECT LOCALIZATION AND GRASP PLANNING>

Jan. 2018 - May. 2018

- Objective :To detect object in monocular image and plan a grasp based on intent
- Segregated object from background using super pixel segmentation
- Created solid model from point cloud using ball pivoting algorithm
- Simulated the grasping using Gazebo simulator in ROS

AdvanceTech India Pvt. Ltd

Chandigarh, India

EXOSKELETON R&D INTERN

May. 2017 - July. 2017

- Objective :Building of passive upper body exoskeleton to support senior citizen
- Performed literature survey, market survey and human body data compilation
- Designing a conceptual model of exoskeleton

Undergraduate Research Intern, PAR Lab(Prof. S K Saha)

IIT Delhi, India

RESEARCHER FOR <AUTOMATIC GENERATION OF CAD MODEL OF SERIAL ROBOT>

May. 2016 - July. 2016

- Objective :To develop an application which eases the learning process of robotics.
- Created a script to automatically generate robot CAD model from DH parameters and simulate collision detection and joint Level Jogging
- Introduced way to perform workspace analysis for all custom made robots

Academic Projects

Projects during MSc

Osaka University

DR. YUTAKA NAKAMURA

- Objective 1:To create a mind map of user preferences during their daily activities
- Created wearable device setup with raspberry pi for recording daily activities and prepared ensemble of models to detect and summarize daily activities.
- Objective 2: Free-energy based motion generator for human robot interaction.
- Improved upon previous research by incorporating gaze and attention feature in the motion generator.

B.Tech Thesis on "Pitch Oriented Gesture Mapping and Engagement evaluation in Human Robot Interaction"

IIT Ropar

DR. ABHINAV DHALL, DR. EKTA SINGLA

- Objective :To map robot's gesture according to it's speech while modulating it and evaluate robot's performance in social context
- Identified dominant gestures from TED talks and extracted the pose values
- Created a mapping between speech and gesture. Also performed speech attenuation based on user's identity
- Performed social survey to evaluate robot's performance

Machine Learning

IIT Ropar

DR. NARAYANAN CHATAPURAM KRISHNAN

- **Movie Success Prediction** : Implemented a neural net architecture to predict success of movie based on it's gross income. Using widely available features like genre, actors, director,setting etc. We received 69% accuracy for tmdb movie dataset
- **Behavior Cloning** : Implemented a neural net model to predict steering angle based on the captured image.
- **Optical Character Recognition** : Implemented K-means clustering and principal component analysis on MNIST dataset to recognize hand written characters
- **Movie Sentiment Analysis** : Implemented decision tree on IMDB review dataset to understand the sentiment of average reviewers about the movie

Computer Vision

IIT Ropar

DR. ABHINAV DHALL

- **Face Beautification App** : Created an android application to improve the facial texture of captured image in real time. We used pure image processing approach to increase color saturation and reduce unevenness in skin tone.
- **Auto-rickshaw detection** : Using Fast R-CNN to detect auto-rickshaw in the wild.
- **Corner and edge detector** : Implemented Canny edge detector and Harris interest point detector.
- **Collage Maker** : Created an application to decide optimal arrangement of any given set of images to make an eye catching collage.

Artificial Intelligence

IIT Ropar

Dr. Narayanan Chatapuram Krishnan

- **The Pacman Project** : Implemented reinforcement learning for the pacman agent to find out the optimal path to goal state and the state transition rewards. Implement mini-max agent to competitively play the game. Implemented BFS and DFS on the agent to understand their effect on the agent's actions
- **Sudoku Solver** : Transformed sudoku into a CSP and used miniSAT solver to find the solution to sudoku problem.
- **Coal Block Allocation** : Implemented hill-climb algorithm to maximize the revenue while allocating the coal blocks to different firms.
- **Block world planner** : Implemented A* search and goal stack planning on robotic arm in block world to move block in desired way on the table.

Heat and Mass Transfer & Fluid Mechanics

IIT Ropar

Dr. Sarit Kumar Das, Dr. Himanshu Tyagi, Dr. Ranjan Das, Dr. Purbarun Dhar

- **Vaccine transportation tank** : Created a mathematical model of vaccine storage tank which can be used to transport vaccines over long distance while maintaining a specified temperature range. We mathematically proved that our design was working and stable.
- **Long Jumper's Leg Motion Study** : As part of fluid mechanics course we studied the added benefit of long jumper's leg motion after takeoff. Our study concluded that rotatory motion of the legs reduces the chances of toppling before landing on the ground.

Product Design And Realization

IIT Ropar

Dr. Prabir Sarkar

- **Variable Height Grass Cutting Mechanism** : We used reverse engineering on a grass cutter and made it height adjustable using four bar linkage and paddle based lifter to adjust the height.
- **Multi-angle foldable crutch** : We made a crutch that is universally accessible and adjustable. It can be adjusted as per the need of user. We kept the BOM as low as possible to make it universally accessible.
- **New Design Of Stapler's Mechanism** : We introduced a new stapler mechanism which maximize the force multiplication using lever system in combination with gear mechanism.We applied this project for patent with temporary ID- TEMP/E-1/38067/2015-DEL.

Extracurricular Activity

ROBOCON (International Level Robotics Competition)

IIT Ropar, India

Core Member & Student Head in 2017 — *Aug. 2016 - Mar. 2017*

- Formed IIT Ropar's first ever Robocon team with 17 members.
- We created a mobile robot which could perform the tasks mentioned in the event theme.

Advitiya (Tech Fest of IIT Ropar)

IIT Ropar, India

Member — *Mar. 2017*

- Presented a performance by humanoid Nao at the inaugural function of maiden edition of Advitiya.
- Set up a stall to provide information about work going on humanoid robotics in IIT Ropar.
- Present the work of IIT Ropar's robotics lab in front of local news channel.

Workshops (Hosted during different events across India)

India

Attendee — *Dec. 2014 - Jun. 2018*

- Organized and instructed at a mini workshop aimed at spreading awareness about Nao humanoid robot and it's preliminary work around at IIT Ropar
- Attended a workshop/information session on ROBOCON organised by AKGEC Gaziabad and IIT Delhi. It included information sharing session and lab tours.
- Attended a workshop on configuring touch screen to take input for robots. It was organised by Entrench Technologies at IIT Ropar
- Attended an introductory workshop on Arduino programming organised at IIT Ropar.

Athletics (Sports team of IIT ropar)

IIT Ropar, India

Member — *Jul. 2014 - Mar. 2016*

- Participated in Summer sports camp under the swimming event category.
- Participant in discus throw event.
- Participated in inter year sports championships.

Technical Skills

Programming Language: **Proficient**: C#, Java, Python | **Prior experience**: R, SQL, C, HTML

Software Packages: MATLAB, Caffe, TensorFlow, Keras, PyTorch, ROS, Solidworks, Autodesk Inventor, OpenSim

Platforms: Linux, Windows

Courses Attended

Online Courses:	Advanced Reinforcement Learning, Game Theory
Masters Courses:	Intelligent Robotics, Intelligent Mathematical Programming System, Signal Analysis Theory, Adaptive System Theory, System Optimization and Analysis, Data Science and Case Studies I, Medical Virtual Reality, Database Systems
Undergraduate Courses:	Artificial Intelligence, Machine Learning, Computer Vision, Data Structure, Introduction to C, Introduction to Robotics, Machine Element Design, Theory Of Machines, Bio-Mechanics, Control Engineering, Laboratory Phonology, Neurolinguistics, Mathematics Laboratory, Partial Differential Equations, Ordinary Differential Equations, Advanced Calculus

Scholastic Achievements

2019	**Monbukagakusho Scholarship**, Japanese Govt. scholarship for pursuing higher studies in Japan	*Japanese Embassy*
2018	**Class Rank 1**, Obtained highest GPA among all students in the department	*IIT Ropar*
2015	**Merit Scholarship**, Awarded for scoring among top 7% across all departments.	*IIT Ropar*
2014	**99.76 Percentile**, Secured in JEE-Advanced 2014(among 1.5 million candidates)	*India*
2014	**Scored 100/100**, Secured a perfect score in Informatics Practices at A.I.S.S.C.E conducted by CBSE	*K.V.No1 Agra*
2012&13	**JMO Qualified**, Cleared district and zonal level maths olympiad, did not participate at nationals.	*Agra*
2012	**99.8 Percentile**, secured in Problem Solving Assessment conducted by CBSE	*K.V No1 Agra*

Honors & Awards

National

2018	**Institute Merit Certificate** , Director, IIT Ropar
2014	**Letter of Appreciation**, MHRD, Government of India
2014	**Certificate of Excellence**, Central Board Of Secondary Education

Recommendations

Dr. Abhinav Dhall — *abhinav@iitrpr.ac.in*
Assistant Professor, CSE Department — *Dec. 2016 - PRESENT*

Dr. Ekta Singla — *ekta@iitrpr.ac.in*
Associate Professor, HOD, ME Department — *Dec. 2010 - PRESENT*