NEHA BARANWAL

Ph.D (Human-Robot Interaction), Post-doc (Robot-Robot Collaboration)

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https://scholar.google.co.in/citations?user=MBgGDPYAAAAJhl=en https://github.com/Neha-Baranwal

EXPERIENCE

Senior AI Researcher

Kaliber Labs, India

February 2022 – Ongoing Hyderabad, India

Kaliber labs is a U.S. based startup that deals in U.S. healthcare systems. Here I am working as a senior ai researcher where my work is to design the architecture of the project and assure its delivery.

- To hire more people into the team. Work allocation, monitoring client deliveries, and identifying the gaps in the current process flow to propose machine learning solutions.
- Out of body segment classification in surgery videos: Given the endoscopy surgery videos, the task is to classify body segments that are not part of the body using vgg-16 and ResNet-50. Here we also applied different augmentation techniques scaling rotation etc.
- Scene change detection: Given the endoscopy video we try to find out where there is a change on the basis of anatomy and tool. In this, we combined tool, anatomy and bad frame model to get the proper results.
- Pathology Segmentation: Given the endoscopy video we look for the pathology part and segment it. We used MaskRCNN, U-Net model to get the proper segmentation.

ML/DS thesis supervisor

UpGrad, India

January 2021 – Ongoing Part-Time

Upgrad is an education learning platform. It provides various courses such as MBA, MS, Deploma etc. in ML/DS/AI.

- Supervising students in their master thesis.

Mentor

Great Learning, India

January 2022 – Ongoing Part-Time

Great Learning is an educational learning platform. It provides various courses such as MBA, MS, diploma, etc. in ML/DS/AI.

- Mentoring students in their projects.
- Taking sessions related to projects.

Senior Researcher

Montpellier University, France

Nov 2020 – December 2021 Montpellier, France

I am associated with the electronics lab (LIRMM) and worked on seatizen project. As a part of the project, I worked on the classification of marine species and checked the health of the sea.

EDUCATION

Ph.D. in Human-Robot Interaction

Indian Institute of Information Technology, Allahabad, India

Nov2011 – Feb2017 CGPI: 9.0

Thesis title: On effective human-robot interaction using multimodel techniques.

M.Tech. in Computer Science

KIIT University, Bhubaneswar, India

Jul2009 – Jun2011 CGPI: 8.89

Thesis title: Spread spectrum based audio watermarking techniques.

M.Sc. in Computer Science

Allahabad University, Allahabad, India

Jul2007 – Jun2009 Per: 68%

COURSE WORK

Soft Computing | Image Processing | Robotics & Industrial Automation | Computer Vision | Pattern Recognition | Research Methodology

SKILLS

- **Machine Learning** ●●●●○
- **Computer Vision** ●●●●○
- **Deep Leaning** ●●●○○
- **Natural Language Processing** ●●○○○
- **Git** ●●●○○
- **Jira** ●●●○○
- **Slack** ●●●○○
- **Docker** ●●●○○

- Marine species classification: Given the RGB images and their meta data we classified marine species such as sea grass, sea cucumber, fish, turtle etc. using ResNet-50, DensNet.
- Deep learning optimization: Given the deep learning algorithm we optimized inferencing upto the level where it can be used in microelectronic devices.

Associate Solution Leader

Brane Enterprises LLP

April 2020 – Oct 2020 Hyderabad

Brane is a private Indian startup that deals in AI and Robotics products, As a leader my responsibilities were:

- To hire more people into the team. Work allocation, monitoring client deliveries, and identifying the gaps in the current process flow to propose machine learning solutions.
- To design the architecture of machine learning solutions.
- We had developed a no-code platform that helps user to load the training population, configure the hyper parameters and then allow training and deploy the model without writing a single line of code. Here we used LSTM, graph neural network to make the complete eco system.

Postdoctoral Researcher

Umea University, Sweden

November, 2017 – Jan, 2020 Umea, Sweden

During the postdoc, I worked on humanoid robots. We train them to assist humans in the household scenarios.

- We designed a dialogue based human robot interaction system that allows humans, to talk to the robot.
- A dialogue generation system is added to translate robot's action into the natural language so that they would be understandable.

Associate Process Manager

eClerx Services Limited

April, 2016 – August, 2017 Navi-Mumbai, India

eClerx is an Indian IT consulting and outsourcing multinational company. I worked there as a full stack developer and my job was to design and develop NLP, ML solutions. Here i used word2vec, globe, Spacy parcer, Baye's network, SVM. We used image preprocessing to improve OCR (tresseract, google) accuracy, further to integrate these solutions with RPA system. I have supervised junior members of the team.

RESEARCH PROJECTS

Fusion of gesture and speech for increased accuracy in human robot interaction

Umea University, Sweden

An approach for decision-level fusion for gesture and speech based human-robot interaction (HRI) is proposed. A rule-based method is compared with several machine learning approaches. Gestures and speech signals are initially classified using hidden Markov models, reaching accuracies of 89.6 percent and 84 percent respectively. The rule-based approach reached 91.6 percent while SVM, which was the

Headless servers ●●●○○

MOST PROUD OF

Seatizen Project (2020-2025)
Selected for the Post-Doc position on health monitoring of underwater sea species at LIRMM Montpellier, France.

Postdoc funding from Kemphe Foundations, Sweden
Received 2.5 years of research funding to pursue my postdoctoral work in Human-Robot Interaction at Umea University, Sweden.

Spot Award for project negative news analysis
Selected for spot award at eClerx, India.

DST travel grant, India
Selected for DST travel grant for attending 35th IEEE TENCON 2015 conference held in Macao, china, 1-4 Nov. 2015 at IIITA, India.

Best paper award
My publication got selected for best paper award in 3rd IEEE International Conference on Advances in Computing, Communications, and Informatics (ICACCI 2014) at IIITA, India.

MHRD, India PH.D Fellowship
Selected for the Ph.D under the robotics and AI lab, IIITA

PROGRAMMING SKILLS

Python ●●●●●

MATLAB ●●●○○

INVITED TALKS

An Empirical Review of Calibration Techniques for the Pepper Humanoid Robot's RGB and Depth Camera

Intelligent Systems and Applications.

5th Sept 2019 London, England

Occasion: Presented conference paper in IntelliSys 2019.

Fusion of Gesture and Speech for Increased Accuracy in Human Robot Interaction

best of all evaluated machine learning algorithms, reached an accuracy of 98.2 percent on the test data. A complete framework is deployed in real time humanoid robot (NAO) which proves the efficacy of the system.

Techniques: Multi-Layer Perceptron, CNN, DWT
Platform: Python, Choregraphe, TensorFlow.

Understandable Collaborating Robot Teams

Umea University, Sweden

We investigate understandability for teams of robots collaborating to solve a common task. We present a novel and flexible solution based on Cooperating Distributed Grammar Systems and a multi-agent algorithm for coordination of actions. The solution is implemented and evaluated on three Pepper robots collaborating to solve a task while commenting on their own and other robots' current and planned actions.

Techniques: Cooperating Distributed Grammar System, Multi-Agent System, Natural Language Generation.
Platform: Python, Choregraphe.

Development of a framework for human–robot interactions with Indian sign language using possibility theory

IIIT, Allahabad, India

This paper demonstrates the capability of NAO humanoid robot to interact with hearing impaired persons using Indian Sign Language (ISL). Principal contributions of the paper are: wavelet descriptor has been applied to extracting moment invariant shape future of hand gestures and possibility theory (PT) has been used for classification of gestures. Preprocessing and extraction of overlapping frames (start and end point of each gesture) are the other major events which have been solved using background modeling and novel gradient method. We have shown that the overlapping frames are helpful for fragmenting a continuous ISL gesture into isolated gestures. These isolated gestures are further processed and classified. During the segmentation process some of the geometrical features like shape and orientation of hand are deformed, which has been overcome by extracting a new moment invariant feature through wavelet descriptor. These features are then combined with the other two features (orientation and speed) and are classified using PT. Here we use PT in place of probability theory because possibility deals with the problem of uncertainty and impression whereas probability handles only uncertainty issues. Experiments have been performed on 20 sentences of continuous ISL gestures having 4000 samples where each sentence having 20 instances. In this dataset 50

Techniques: Possibility Theory, Nao Speech Engine, HMM.
Platform: Matlab, Choregraphe, NAOqi.

INDUSTRIAL PROJECTS

Out of body segment classification

Kaliber Labs

We designed an algorithm that would classify out-of-body segments from endoscopy videos. We applied ResNet-50 and CNN+LSTM to classify images. Total 50000 images was used where 60 percent is used for training and 30 percent was used for validation and 10 percent was used for testing. Window based smoothing was used as postprocessing to get a better result. To handle the datadrift problem we trained the model using semi supervised learning approach.

25th International Conference on Methods and Models in Automation and Robotics

24th Aug 2019 Międzyzdroje, Poland

Occasion: Presented conference paper in MMAR 2019.

Deep Learning

3-Day workshop at LIRMM, Montpellier University, France

22nd July–24 July 2021 Montpellier, France

Occasion: Organized 3-day workshop on deep learning.

Understandable human-robot interaction

Computing science department, Umea University

18th June 2019 Umea, Sweden

Occasion: Poster presentation in 31st Swedish AI Society Workshop.

Robotic Manipulator and sketch drawing

WASP-Wallenberg Foundation

11th April 2018 Stockholm, Sweden

Occasion: Presented live demo in AI4X- Collecting Ideas and Identifying Challenges for Future AI Research in Sweden.

Robotics

Department of Electronics and CSE SUIIT, Sambalpur University, Burla, Odisha, India

30th April 2021 Sambalpur, India

Occasion: Delivered talk in International workshop on recent advancements in electronica and computer advancement.

Deep Learning

LIRMM, Montpellier University, France

28th June 2021 Montpellier, France

Occasion: Delivered talk at MIC DAY organized by Microelectronics department.

Artificial Intelligence and the Future of Robotics

Centre for Artificial Intelligence, Banasthali University, Rajasthan, India

22nd March 2021 Rajasthan, India

Occasion: Delivered talk at Faculty Development Programme on Artificial Intelligence, Robotics, and Automation.

Techniques: Vgg-16, ResNet-50, CNN+LSTM
Platform: Python, TensorFlow, Keras.

Scene change detection

Kaliber Labs

We are given an endoscopy videos, our task is to identify changes on the basis of tool and anatomy. Here we used 4 models (Inside/outside, good/bad, anatomy and tool) clubbed together and get the final output which we saved in csv file where each column represents the results of one algorithm. Distance based method is used to identify changes presents in csv file. Smoothing is also used to remove outliers.

Techniques: Transfer Learning, MASKRCNN, U-Net
Platform: Python, TensorFlow, Keras.

Email Classification

Credit Suisse International

A classification system requires two things, features which can represent the sample in the feature space (vector form) and classifier who will classify these feature to their respective classes. We have used bag of words, nGram, and TF-IDF to define the features while Linear, Naïve Bayes, Support Vector Machines are used to classify these emails to one of the defined classes. Since email signatures, Images etc. are not required in email classification. A separate preprocessing module is written for email cleansing.

Techniques: TD-IDF, Bayes (Multinomial, Unigram), Linear Classifier, SVM.
Platform: Python, Scikit, Numpy, Beautifulsoup, NLTK, SQL.

Negative News Scanning

eClerx Services

We need to find the relative information about the person/organization from the given sources(websites) and then estimate that the extract information is positive or negative. Here the term negative symbolizes that the entity is involved in money laundering or any illegal activity in the past. We used web scrapping to download the information and then applied anaphora resolution to identify the sentences related to the entity. Later we used sentiment analysis over the collected samples.

Techniques: TD-IDF, nGram (unigram, bigram, trigram), Logistic Regression, SVM.
Platform: Python, Scikit, Numpy, Beautifulsoup, NLTK.

Intent Classification

Brane enterprises LLP

Intent Detection and Slot Filling is the task of interpreting user commands/queries by extracting the intent and the relevant slots. HR dataset was considered. The slots are labeled in the BIO (Inside Outside Beginning) format (similar to NER). Encoding was extracted using Bert then these encodings was fed into LSTM model to get the intent and slot.

Techniques: Bert, LSTM.
Platform: Python, Tensorflow, Keras.

SELECTED PUBLICATIONS

Journal Articles

Possibility Theory based Continuous Indian Sign Language Gesture Recognition

TENCON a premier international technical conference of IEEE Region 10

1st Nov 2015 Macau, China

Occasion: Presented conference paper in TENCON 2015.

CERTIFICATIONS

Social network analysis (SNAW'12)

Indian Statistical Institute, Kolkata, India

27 June – 28 June 2012

Occasion: National workshop organized by Center for Soft Computing Research.

Computing Techniques and Applications

Banaras Hindu University, Varanasi, India

1 July – 7 July 2012

Occasion: National workshop cum training program organized by Mathematics Department.

Machine Learning

Indian Institute of Technology, Kanpur, India

1 July – 3 July 2013

Occasion: 1st Indian Workshop organized by computer science department.

Image Processing, Computer Vision and Pattern Recognition

National Institute of Technology Delhi, India

18th June – 22 June 2013

Occasion: Faculty Development Program organized by computer science department.

PDE Modeling and Computation

Indian Institute of Technology Madras, India

21 Oct – 25 Oct 2013

Occasion: DAAD Supported International Workshop organized by Department of Mathematics.

ACADEMIC SERVICES

- Organizing committee member of "SERB sponsored 1st summer school on robotics", organized by IIIT Allahabad.
- Served as a Publicity Chair in Second International Symposium on Women in Computing and Informatics (WCI-2014).

- Singh, Avinash Kumar, Neha Baranwal, Kai-Florian Richter, Thomas Hellström, et al. (2020b). "Verbal explanations by collaborating robot teams". In: *Paladyn, Journal of Behavioral Robotics* 12.1, pp. 47–57.
- Baranwal, Neha and Gora Chand Nandi (2017a). "A mathematical framework for possibility theory-based hidden Markov model". In: *International Journal of Bio-Inspired Computation* 10.4, pp. 239–247.
- – (2017b). "An efficient gesture based humanoid learning using wavelet descriptor and MFCC techniques". In: *International Journal of Machine Learning and Cybernetics* 8.4, pp. 1369–1388.
- Baranwal, Neha, Gora Chand Nandi, and Avinash Kumar Singh (2017). "Real Time Gesture Based Communication Using Possibility Theory Based Hidden Markov Model". In: *Computational Intelligence* 33.4, pp. 843–862.
- Baranwal, Neha, Avinash Kumar Singh, and Gora Chand Nandi (2017). "Development of a Framework for Human–Robot interactions with Indian Sign Language Using Possibility Theory". In: *International Journal of Social Robotics* 9.4, pp. 563–574.
- Baranwal, Neha, Shweta Tripathi, and Gora Chand Nandi (2014). "A speaker invariant speech recognition technique using HFCC features in isolated Hindi words". In: *International Journal of Computational Intelligence Studies* 3.4, pp. 277–291.

Conference Proceedings

- Singh, Avinash Kumar, Neha Baranwal, and Kai-Florian Richter (2020). "A Fuzzy Inference System for a Visually Grounded Robot State of Mind". In: *Proceedings of the Europian conference on artifical intelligence, (ECAI 2020), Santiago de Compostela, Spain, 29 Aug-2 Sept 2020*. Spain: ECAI2020.
- Singh, Avinash Kumar, Neha Baranwal, Kai-Florian Richter, Thomas Hellström, et al. (2020a). "Understandable collaborating robot teams". In: *International Conference on Practical Applications of Agents and Multi-Agent Systems*. Springer, pp. 168–178.
- Baranwal, Neha, Avinash Kumar Singh, and Suna Bench (2019). "Extracting primary objects and spatial relations from sentences". In: *11th International Conference on Agents and Artificial Intelligence, Prague, Czech Republic, 19-21 February 2019*.
- Baranwal, Neha, Avinash Kumar Singh, and Thomas Hellström (2019). "Fusion of gesture and speech for increased accuracy in human robot interaction". In: *2019 24th International Conference on Methods and Models in Automation and Robotics (MMAR)*. IEEE, pp. 139–144.
- Baranwal, Neha, Kumud Tripathi, and GC Nandi (2015). "Possibility theory based continuous Indian Sign Language gesture recognition". In: *TENCON 2015-2015 IEEE Region 10 Conference*. IEEE, pp. 1–5.
- Baranwal, Neha, Neha Singh, and GC Nandi (2014). "Indian sign language gesture recognition using discrete wavelet packet transform". In: *2014 International Conference on Signal Propagation and Computer Technology (ICSPCT 2014)*. IEEE, pp. 573–577.

- IEEE Professional Student Member.

LANGUAGES

Hindi ●●●●●

English ●●●●●

French ●○○○○

Swedish ●○○○○

REFERENCES

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Declaration
I hereby declare that the above mentioned particulars are true to the best of my knowledge and belief.

Date:

Place: Neha Baranwal