M. HANAN GANI

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SUMMARY

In quest of achieving the desired goals and motives of life. Driven by a passion to contribute towards the development of society and utilize technology to solve humanity's pressing issues. Besides, the virtues of Leadership, Collaboration, Problem Solving, and Innovation are imbibed in me.

EDUCATION

- **National Institute of Technology (NIT)** — *Srinagar, India*
  Bachelor of Technology (B.Tech), Electronics and Communication Engineering — 2014-2018
  Overall GPA: 8.561/10 (Among top 5 of the class)

- **Saint Joseph's Higher Secondary School** — *Baramulla, J&K (India)*
  Higher Secondary Part II (Class XII), JKBOSE — 2014
  Percentage: 96% — Major in Physics, Chemistry, Mathematics and English (Among top 10 of roughly 35K students in the entire J&K state)

WORK EXPERIENCE

- **Harman International, Inc. (Samsung)** — *Bengaluru, India*
  Machine Learning Research Engineer — Oct 2018 - Present
  Subdivision: Harman Connected Car R&D
  Job description: Active engagement in research and development work along with designing cutting technology for car infotainment systems and finding solutions to the infotainment problems by employing state of the art Artificial Intelligence techniques.

- **Telecommunications Consultants India Limited (TCIL)** — *Chandigarh, India*
  Security and Networking Intern — Dec 2016 - Feb 2017
  Job description: Study, design and develop various secure communication systems.

RESEARCH EXPERIENCE

- **Independent and External Collaborations** — March 22, 2020 - Present
  Projects: ☐ ***Detecting Skin Lesion using Deep learning***: (collaboration with a PhD student from IIT Jodhpur, India [akhter.1@iitj.ac.in]). This research project is based on detecting skin lesions using dermoscopic images. The dataset used is the HAM-10000 dataset containing all important diagnostic categories in the realm of pigmented lesion. Two approaches have been utilised till now, one being a convolutional neural network based approach and second is a segmentation based approach using U-Net architecture. Significant progress has been achieved till now. The work is still in progress.

  ☐ ***Detecting Alzheimer's patient from linguistic cues: A case study involving performance comparison of various deep learning approaches***: (collaboration with a PhD student from SMVD University, India [18dcs006@smvdu.ac.in]). This research project is based on detecting Alzheimer's patients from their language pattern. The dataset used is the Dementia Bank dataset containing the audio transcripts of individuals on the task of "Recall Test". Three neural net models (LSTM, BiLSTM, CNN-LSTM) and two transformer based models (BERT & XLNET) were separately trained with same set of data and the performance comparison was done on the basis of test set accuracy, F1 and ROC/AUC scores. BERT and XLNET were found to be outperforming all the other models. The model and related metrics are available in my GitHub repository (github.com/hananshafi/Alzheimer-s-Detection).

  ☐ ***Detection of Novel Corona Virus (COVID-19) from Chest X-Rays***: Developed a Deep Learning model that can detect COVID-19 from chest X-Rays. The model is trained on limited publicly available dataset and can predict two classes: COVID-19 and NON-COVID-19 (Pneumonia Viral, Pneumonia Bacterial and Normal). The current accuracy on test set is reported as 95%. However, there is room for improvement with more data. The model and related statistics are available in my GitHub repository (github.com/hananshafi/covid19-detection). This work got featured in COVID-19 Open Innovation Challenge workshop organized by the Innovation, Incubation and Entrepreneurship Development (IIED) center at NIT Srinagar. It was one of the earliest works globally in detecting COVID-19 done at the onset of April 2020.

  ☐ ***Detecting COVID-19 from clinical reports of patients***: This project aims to detect COVID-19 patients from their clinical reports through deep learning approach. The clinical reports contain information about lung analysis, age, body temperature, pO2 levels etc. The model is trained on these aspects and is able to detect patients with COVID-19 at a reasonably good accuracy. Due to limited data, model is still in development stage. However, with the availability of more data and variations, model can be improved. The model and related statistics are available in my GitHub repository (github.com/hananshafi/Covid19-ClinicalReports-Detection).

  ☐ ***COVID-19 Infection and Mortality Risk***: The primary goal of this project is to predict the probability with which a person might contract COVID-19 along with his / her mortality probability. The infection risk score can give an idea of whether a person is taking proper precautions or not. The mortality score can give an idea to medical professionals as to which patient might need a ventilator. A pipeline containing a neural network model and a random forest regressor takes into account certain parameters such as age, BMI, smoking, drugs consumption, environmental factors, precautions, contacts, existing ailments etc. to estimate these risks. The model and training code is available in my GitHub repository (github.com/hananshafi/COVID19-Infection-and-Mortality-Risk).

  ☐ ***Predicting Spread of COVID-19 in India and Kashmir***: Keeping in view the drastic rate of increase of COIVD-19 cases, I tried to mathematically model the spread of COVID-19 using Deep Learning (Bidirectional LSTM) which takes into account the trend of cases before and after lockdown, and predicts the number of new cases in future. The model can currently predict the number of new COVID-19 cases for limited days in future (at-most a week ahead) with an accuracy of 90%-95% (featured in "COVID-19 Open Innovation Challenge" workshop organized by the IIED center at NIT Srinagar.) (github.com/hananshafi/Covid-19-Mathematical-Spread)

- **Harman International - Connected Car R&D** *Bengaluru, India*
  Machine Learning Research Engineer Oct 2018 - Present
  Subgroup: Global Test Automation (GTA) - Machine Learning R&D Team
  Projects and Research work: ☐ ***Screen Reliability - detecting anomalies on HMI screens***: The project is based on detecting anomalies in a continuous video stream (on HMI screen). Anomalous events pertain to any glitches in the HMI screen display, an area which hasn't been explored much by the research community. Three approaches have been studied and implemented for this project. The first approach is based on using a convolutional Auto-encoder network with transposed convolutions for upsampling in the decoder network, trained on normal images. Second approach uses a conditional Generative Adversarial Network, having encoder-decoder-encoder sub-networks in the Generator network, which is inspired from the 'GANomaly' paper and is trained on normal images as well. Third approach utilizes a [Encoder-Decoder]-CNN architecture influenced from the "Adversarially Learned One-Class Classifier for Novelty Detection (ALOCC)" CVPR'18 paper, which is trained in adversarial fashion. The anomalous test images have been synthesized manually taking into the consideration the possible screen outliers. The three approaches have achieved significant results till now with the last approach performing slightly better. (production ready)

  ☐ ***Grouping contextually similar texts together using SBERT and DistilBert***: The project is based on clustering / grouping contextually similar sentences together using Sentence BERT (SBERT) which is a BERT network using siamese and triplet network, as described in the SBERT paper. Sentence BERT is first trained on a huge corpus of data containing positive and negative pairs of sentences from a specific domain, with base model being BERT base.The model is then used to compute embeddings of another set of data pertaining to the same domain. The embeddings generated are clustered using K-Means. The silhouette score is used to determine the number of optimum clusters. The project is further scaled to exploit the DistilBert model to find the contextually similar sentences by converting text prompts into vectors using a trained DistilBert model and then utilising cosine similarity to group the similar text prompts together. (currently being used in production at Harman facilities)

  ☐ ***Log Failure Categorization***: This project is based on extracting useful information regarding the cause of failure from plethora of error logs generated from various test executions. A machine learning pipeline is developed which classifies failure text logs into two categories depending on whether the failure was from software side or hardware side. The pipeline contains a set of statistical machine learning models, a neural network model and a BERT model for training. The pipeline automatically determines the best performing model based on accuracy and f-1 score and uses that specific model for inferring on error log data. (currently being used in production at Harman facilities)

  ☐ ***Hybrid Icon Detection Model***: Developed a Hybrid Deep Learning Icon Detection Model that can detect various icons on HMI screen images. The model is robust to any kind of changes like background variations, screen or icon scaling, resolution changes and icon shape changes. The hybrid implementation combines the results from deep learning model and statistical machine learning model, and gives the final bounding box outputs. (currently being used in production at Harman facilities)

  ☐ ***NLP Intent Handler Mechanism***: Developed an end to end flow of pipeline for understanding intents from input prompts which may be in the form of input sentences or logs. The GloVe word emebedder is used to convert the inputs into embeddings which represent the actual underlying intent. The intents are mapped to various API's and based on the type of intent, the corresponding API's pointing to that intent are executed.

  ☐ ***Unsupervised Clustering***: To deal with the diverse range of sizes, colors and shapes of similar icons on various HMI screens in the iOS and android domains, I developed a Clustering API which first extracts the icons from HMI screen images, then a CNN model trained on specific images of given domain is utilized to find the most relevant features. KMeans clustering, with clusters determined from elbow method, is then applied on these features to get the clusters with similar icons clustered together.

  ☐ ***Image Augmentation using Generative Adversarial Networks (GAN's)***: To cater to the need for the availability of enough diverse set of image data for training, I developed a GAN model that augments high quality HMI screen images and generates new images. The generated images were then used to further train different object detection and classifier models.

  ☐ ***Context Classifier***: Worked on Deep learning based Context Classifier which classifies high resolution HMI screen images under different categories based on the requirements. The deployed CNN model is robust enough to take care of the high degree of pattern overlap in HMI images and is being currently used by the Company on a large scale to test their products. (currently being used in production)

  ☐ ***Word to Vec similar Issue Recommender***. This project is based on recommending similar issue fixes in past given a new issue. A software issue in the form of sentence prompt is fed as input and a Word2Vec model (trained on large corpus of data) converts this information into an embedding vector which is matched with the embedding vectors of previous records in the database. On the basis of cosine similarity score, the model recommends similar types of software issues that had been fixed in the past. It gives an idea to the user / developer as to what fix could be applied to the issue. (currently being used in production at Harman facilities)

  ☐ ***Code to Vec***: The project aims to find how much correlated the source code files are using the vectorial representation of code. The java codes are fed through a pipeline and are converted into vectors using the Code2Vec model provided by the authors of *Code2Vec* paper which is trained on huge corpus of java codes. The cosine similarity scores are then referred for finding the most similar pairs of java code files.

- **Indian Institute of Science (IISc)** *Bengaluru, India*
  Deep Learning and Computer Vision Researcher Full time: Dec 2017 - Feb 2018 , Part time: March 2018 - June 2018
  Lab: Computational Intelligence & UAV Lab, Aerospace Engineering Department, IISc
  Highlights of Research: Carried out extensive research in Deep Learning and Computer Vision and worked on Project ***Disguised Facial Recognition using Deep Learning***. This research project presents a novel approach for disguised facial recognition using a novel Deep Convolutional Neural Network which detects 20 essential key-point features on face. These 20 key-point features are then utilized by an artificial neural network / SVM for recognition task. The performance achieved state of the art results.

- **National Institute of Technology (NIT)** *Srinagar, India*
  Student Researcher October 2017 - June 2018
  Supervisors: Dr. Shahid Mehraj Shah (Assistant Professor, NIT Srinagar, mail: shahidshah@nitsri.net), Dr. G. R. Begh (Associate Professor, NIT Srinagar, mail: grbegh@nitsri.ac.in)
  Project work: ☐ ***Machine learning based channel estimation***: Developed an efficient Machine Learning based method to estimate Channel Parameter 'H' in Wireless Communication System. 'H' parameter presents sum total of all the factors influencing the input signal when it travels from source to receiver and is represented as Gaussian Noise. The motive is to get the original sent input. To accomplish this, I exploited the Machine Learning technique of Least Squares Estimation to estimate 'H' parameter. (full Proficiency).

  ☐ Developed a ***Real time Emotion Recognition System*** that recognizes five types of emotions from facial expressions: sad, happy, angry, surprise and neutral. A standard (sequential) and inception style CNN architectures were deployed and separately trained on FER benchmark dataset. The test set results were used to compare the performance of the two architectures.

PUBLICATIONS

- S. Kumaar, A. Majeedi, A. Dogra, H. Gani, R. M. Vishwanath and S N Omkar. *Disguised Facial Recognition using Neural Networks.* **IEEE 3rd International Conference on Signal and Image Processing (ICSIP)**, Shenzhen, China, 2018, pp. 28-32. doi: 10.1109/SIPROCESS.2018.8600440

- Saumya Kumaar, Abrar Majeedi, Hanan Gani, Abhinandan Dogra, Ravi M. Vishwanath and S N Omkar. *A Supervised learning Methodology for Real time Disguised Facial Recognition in Wild.* Published on **arXiv:1809.02875[cs.CV]**. Accepted to **2018 ACM International Conference on Robotics and Computer Vision (ICRCV)**, Nov 17-18, Thailand.

- ∗ (Note:In both these papers, the contribution of each author is equal. The paper Disguised Facial Recognition using Neural Networks published in IEEE (ICSIP) only displays my email ID and not my name which is a technical error on IEEE side. We have already communicated this error to them and are hoping to get it corrected soon. For verification please contact the corresponding author of the paper)

RESEARCH INTERESTS

☐ Artificial General Intelligence ☐ Self-supervised deep learning ☐ Few shot learning ☐ Causal inference in Machine learning ☐ Graph Neural Networks ☐ 3-D Computer Vision ☐ Optimization ☐ Biomedical imaging and Signal Processing

TECHNICAL AND PROGRAMMING SKILLS

☐ ML and deep learning Libraries & Frameworks: Keras, Tensorflow, Pytorch, OpenCV, Scikit-learn ☐ Python programming, Python for Machine learning and Data Science ☐ MATLAB, SciLab (Limited proficiency) ☐ C Programming, HTML, Databases: {MySql,NoSql MongoDB}, WebAPI Hosting, C#

COURSES TAKEN (MOOC'S WITH CERTIFICATIONS)

☐ Build Generative Adversarial Networks course via coursera.org & deeplearning.ai

☐ AI for medical diagnosis course via coursera.org & deeplearning.ai

☐ Deep Learning - 5 courses (16 weeks) Specialization by Andrew Ng via coursera.org & deeplearning.ai

☐ Machine learning - 4 courses (24 weeks) Specialization — University of Washington via coursera.org

☐ Machine Learning — Stanford University via coursera.org

☐ A crash course in Data Science — Johns Hopkins University via coursera.org

☐ Python programming and Python data Structures: 10 weeks course — University of Michigan via coursera.org

AWARDS, SCHOLARSHIPS, ACHIEVEMENTS AND INVOLVEMENTS

☐ Received Harman Star Excellence award from the Harman International (Global Test Automation) India (Regional) Head for developing two machine learning solutions which are currently helping the Automation teams in India to save a time effort of 2 hours daily   *September 2020*

☐ Presented a talk on the "Role of AI in Education" at the Arifeen School of Excellence (ASE) Orientation program held in Baramulla (Kashmir, India)   *May 2020*

☐ Participation in COVID-19 Open innovation challenge workshop by IIED centre NIT Srinagar, where my independent project "Detection of COVID-19 from chest X-Rays using Deep learning" got featured in the creative and innovative section.   *May 2020*

☐ Merit Based Scholarship granted by Ministry of Minority Affairs, India.   *August 2016 - April 2018*

☐ Certificate of Appreciation for teaching at Super 50 - A Government institute for preparing deserving underprivileged students for professional engineering examinations.   *December 2015 Feb 2016*

☐ Publishing of my exclusive interview with gyawun.org for highlighting my contributions towards the Educational Upliftment and social cause (www.gyawun.com/interview-co-founder-rivero-student-initiativepromote-educational-awareness).   *July 2017*

☐ Organizing member and Participant of workshop 'AI powered UAVs (drones) for agricultural purposes' organized at Department of Aerospace Engineering and Shockwave Research, Indian Institute of Science (IISC), Bengaluru.   *Jan 2018*

☐ Secured 80th state rank in JEE Mains 2014 (among top 1.2% of 1.5 million students across the country).   *June 2014*

☐ Member of 'JK-Scientists' Forum - a group of Scientists and Researchers from my homeland 'Kashmir' working in diverse fields.   *August 2018 - Present*

☐ Best Outgoing student of the school.   *November 2013*

SOCIAL CAUSE AND VOLUNTEERSHIP

- **Rivero** - An initiative for Social Change   *Baramulla, J&K, India*
  Co-Founder   Dec 2016 - Present
  Highlights: Rivero aims at counseling students for various career options and conducting events and workshops for expressing ideas to bring about a social change. Rivero is pretty successful in conducting numerous educational events and workshops and counsel up-to 2000 students till now with majority being underprivileged and conflict affected students.

EXTRACURRICULAR ACTIVITIES & HOBBIES

☐ Active participation in trekking, camps, and sports activities such as cricket, table tennis, football, badminton etc.

☐ Social Networking and Communication

☐ Watching sports activities

☐ Reading technological stuff