# Sankalp Arora

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## EDUCATION

**National Institute of Technology, Kurukshetra** (CGPA 9.3/10)
*Bachelor of Technology in Electrical Engineering* *May 2022*

**Children Senior Secondary School, Kota** (95.4%)
*Higher Secondary School Certificate (XII class)* *2018*

**Mayoor School, Ajmer** (CGPA 9.8/10)
*Secondary School Certificate (X class)* *May 2016*

## RESEARCH INTERESTS

- Deep Reinforcement Learning
- Decentralized Machine Learning
- Self Supervised Representation Learning
- Wireless Technology

## RESEARCH AND TRAINING EXPERIENCE

**Undergraduate Research Assistant | *Decentralized Machine Learning*** Sep. 2020 – June 2021
*MLO Laboratory, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland*

- Worked on DeAI student project, which is an easy-to-use mobile app & web software [**Link**] developed on a **decentralized approach** that enables collaborative and privacy-preserving training of machine learning models
- Used concepts of federated learning to decouple private data for model training using **PySyft**, and Multi-Party Computation (MPC) within **PyTorch** to develop privacy-preserving **federated learning** solutions
- Evaluated different potential **P2P communication** backends such as **PyGrid**, **PeerJS**, and **WebRTC** by combining it with **decentralized SGD** for basic (PyTorch-compatible) training of machine learning model

**Research Trainee | *Reinforcement Learning, Optimization*** Jan. 2021 – June 2021
*Defence Research & Development Laboratory (DRDL), Hyderabad*

- Studied **RL agent** based **Guidance Laws** and **Optimal Control** techniques for Surface-to-Air Missile Guidance
- Simulated optimal trajectory for the Surface-to-Air ballistic missile by implementing **Gradient method** as optimization technique in **MATLAB** [**Code**] under the guidance of *Dr. Prem Kumar (Scientist- 'F', DOS)*
- Implemented Proportional Navigation (**PN Classical Guidance law**) on a point mass 3-d model in MATLAB with **lofting** and used it as a baseline for performance evaluation against RL agent based guidance laws [**Report**]

**Summer Research Fellow | *Self Supervised Learning*** June 2020 – Aug. 2020
*Indian Institute of Technology, Hyderabad - Department of CSE*

- Conducted a thorough literature study, and drafted a long review paper [**Link**] on **Image**, **Video** and **Control** based **Self Supervised Representation Learning** guided by *Prof. Vineeth N.Balasubramanian (Head AI)*
- Explored different state-of-art technologies like **BYOL**, **SimCLR**, **Bisimulation**, **CPC** and learning paradigms such as contrastive learning and asymmetric learning by coding them in **Python** using **PyTorch & TF** [**Code**]

## PROJECTS AND INTERNSHIPS

**Machine Learning Intern | *Data Visualization & NLP*** April 2020 – June 2020
*GetBoarded Technologies, Aveiro, Portugal* *Summer Internship*

- Developed a **Deep NLP** model for fake news detection using **Bert** and **Universal sentence encoder**
- Led the advance ChatBot development team modeling an advanced conversational chatbot by architecturing a **seq2seq** model from scratch by implementing **LSTM**, and **RNN** models using **TensorFlow** and **Python**
- Devised Time-series graphs and complex plots like **Boxen plot** and **Heat maps** from COVID-19 data from John Hopkins University using Seaborn, NumPy and Pandas for the International European hackathon

**Data Analyst Intern | *Data Warehousing*** April 2020
*Takenmind Organization, Gurugram, Haryana* *Summer Internship*

- Worked in a team of interns from 13 different countries, contributing to building an analytical solution to the **Employee Attrition problem** by analyzing what type of employees are prone to leave the company in future
- Analyzed company's employee data to draw useful insights using **Tableau**, **NumPy**, **Seaborn**, and **Pandas**

**GratifAI** | *Temporal Difference Learning, Multi-Armed-Bandit*                    Feb. 2020 – April 2020
- Compared various agents like **Sarsa(0)**, **Expected Sarsa**, and **Q-Learning** on the 'Windy Gridworld' problem
- Experimented with **LSTM-A3C** model to develop an AI for playing Breakout (arcade game) and trying to beat it
- Developed an **AI**, a **Deep Convolutional Q-Learning** model combined to **Eligibility Traces** for playing 'Doom' which is a first person shooting game and trying to beat the high score [**Code**]

**My Stock Trader** | *Deep Reinforcement Learning, Q-Learning*                    April 2020
- Modeled a reinforcement learning agent using **TensorFlow** that participates in **stock trading** by holding, selling, and buying the stocks. Unlike the (Un)supervised models that only make predictions on stock prices
- Implemented Value & Howard Policy Iterations to find the optimal policy for **Markov Decision Problem**
- Experimented with **Vanilla Gradient Descent** and implemented **Momentum** for faster training [**Code**]

## TECHNICAL SKILLS

**Languages**: Python, C++, C, MATLAB, SQL, LaTeX
**Libraries**: NumPy, Pandas, Seaborn, PyTorch, TensorFlow, Keras, OpenAI Gym, Scikit-learn, Theano, Caffe
**Developer Tools**: Git, Docker, Tableau, Google Colab, Google Cloud Platform, PyCharm, AWS, MLBench, WebRTC

## ACHIEVEMENTS AND COMMUNITY CONTRIBUTIONS

- **Phase 1 finalists** | *OpenCV AI Competition*
  - Leader of the team Kurukshetra Warlords chosen as one amongst 10 university team finalists from Central Asia + Southern Asia from over **1400** submissions in **OpenCV AI** Competition 2021 [**Certificate of Achievement**]
  - Recieved 10 **OAK-D** devices that are a spatial AI powerhouse, capable of simultaneously running advanced **neural networks** worth **$2000** from OpenCV organization for developing a visual aid for blind people [**Video**], [**Proposal**]

- **Founder** | *Macrogoogol Machine Learning Flashcards*
  - Self-designed 400+ digital 4x6 inches **Machine Learning Flashcards** making it easy and fun to learn simple and complex concepts ranging from Algebra to Artificial intelligence via visual-based learning

- **Co-Founder and Community Leader** | *KAIR-Kurukshetra AI Research*
  - Goal of KAIR is to reduce skill-gap in the student community, by creating a vibrant AI ecosystem and talent pool
  - Organised Institute's first AI competition in collaboration with AIcrowd- **NIT KKR AI Blitz** [**Website**]

- Delivered introductory sessions on NLP & RL at **Google AI | Explore ML** Advance track workshop [**Certificate**]
- Merit scholarship holder for 2019-20 session (**3$^{rd}$ dept. rank**/138)- Electrical engineering department [**Certificate**]
- One amongst 3, students selected from the Institute for **International Youth Exchange Program 2020** by the Govt. of India to visit the neighboring countries (Nepal/Japan/China) for cultural and academic exchange

## EXTRACURRICULARS

- Awarded '**The Most Promising Athlete Of The Institute**' 2018-19 for outstanding performance in Athletics at Annual Athletics Meet winning 8 medals (1 Gold, 3 Silver, 5 Bronze) in various Track & field events [**Cert.**]
- Stood **first** in B-plan (Business Management competition, where participants pitch their business ideas, Revenue Models, and carry out **SWOT** and **PEST** analysis) at Techspardha, 2019 (NIT KKR Annual Tech Fest)
- Bagged **Silver medal** in **Men's Javelin Throw** at All-India Inter-NIT Athletics Championship 2018 held at NIT Warangal, best athletes from 31 NIT's all over India compete in different athletic events for 4-5 days [**Cert.**]
- **Ecoika**:- Leading a team of three minimalist nature lovers to find alternates and solutions to Ghazipur landfill, which has grown taller than the Taj Mahal [**Pitch**]

## COURSEWORK

- **Massive Open Online Courses**
  - Advanced Machine Learning Specialization - National Research University Higher School of Economics
  - Deep Unsupervised Learning (CS294-158-SP20) - University of California, Berkeley
  - Reinforcement Learning Specialization - University of Alberta
  - Complete Machine Learning and Data Science (6 months) - Coding Ninjas
  - Data Structures and Algorithms in C++ (4 months) - Coding Ninjas

- **Offline/University Courses**
  - Probability and Stochastic Processes
  - Basics of programming
  - Modelling and Simulation
  - Robotics & Control Systems
  - Differential and Integral Calculus
  - Matrix Algebra