

# Jaskirat Singh | Academic CV

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📄 Jaskirat Singh

## Research Interests

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Interactive Image Synthesis and Editing, Artistic Content Generation, Deep Reinforcement Learning.

## Education

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- **The Australian National University** **Expected**  
*Ph.D. in Computer Science* *Sep' 21–Present*  
Supervisors: [Prof. Liang Zheng](#) and [Prof. Stephen Gould](#)
- **The Australian National University** **GPA: 7/7**  
*Master of Machine Learning and Computer Vision* *Jul' 19–Jul' 21*  
🏆 Awarded University Medal for Exceptional Academic Excellence
- **Indian Institute of Technology, Delhi** **GPA: 9.3/10**  
*Bachelor of Technology (B.Tech), Electrical Engineering* *2013–2017*  
**Specialization in Intelligent and Cognitive systems**

## Research/Teaching Experience

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- **Adobe Research** **San Jose, California**  
*Research Intern: Computer Vision, Imaging & Video* *Jun' 21 – Dec' 21*
- **The Australian National University** **Canberra**  
*Summer Scholar: Computer Vision Lab with Prof. Liang Zheng* *Dec' 20 – Feb' 21*
- **The Australian National University** **Canberra**  
*Teaching Assistant: Introduction to Machine Learning (COMP6670)* *Jul' 20 – Nov' 20*
- **Yahoo Japan** **Tokyo**  
*Machine Learning Research Engineer* *Oct' 17– Sept '18*
  - Developed an Ad image-based CTR (click through rate) prediction model using **parameterized CNNs and unsupervised clustering**. Our model **improved the CTR prediction accuracy by 2.3 %** over past methods.
  - Proposed a **novel pricing strategy** to deal with the problem of *unfairness* and attain **Nash Equilibrium** in **online advertising auctions**.
  - Designed an **end to end deep learning pipeline for automated "user target setting"** selection in order to maximize the number of clicks for online Ads.

## Publications

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1. [Paint2Pix: Interactive Painting based Progressive Image Synthesis and Editing](#)  
**Jaskirat Singh**, Cameron Smith, [Jose Echevarria](#), and [Liang Zheng](#).  
Under Review
2. [Intelli-Paint: Towards Developing Human-like Painting Agents](#)  
**Jaskirat Singh**, Cameron Smith, [Jose Echevarria](#), and [Liang Zheng](#).  
Adobe Research Patent, Under Review

3. **Combining Semantic Guidance and Deep Reinforcement Learning For Generating Human-Level Paintings**  
Jaskirat Singh, and Liang Zheng.  
CVPR 2021
4. **Sparse Attention Guided Dynamic Value Estimation for Single-Task Multi-Scene Reinforcement Learning**  
Jaskirat Singh, and Liang Zheng.  
arXiv 2021



## Honors and Achievements

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- **Awarded University Medal** for exceptional academic excellence at the Australian National University.
- Awarded **ANU Computer Science Summer Research Grant** (\$5k).
- **Invited for delivering a tutorial** on "Applying deep reinforcement learning for computer vision research" by the **Australian Centre for Robotic Vision (ACRV)** group.
- Our project "Connected Stories of Australia" has been awarded as the **best innovative design project** by the **National Museum of Australia**.
- **Won national hackday at Yahoo Japan**, among 54 competing teams from all across Japan, for developing a real-time application for **facial attribute modification using reversible GANs**.
- Received **IIT Delhi Merit Award & Scholarship** for outstanding academic performance.
- Secured **All India Rank 128 in IIT-JEE** among 1.4 million aspirants appearing for the exam.
- Won the **Silver Medal at National FIDE Rated Chess Tournament**.


## Other Research Projects

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- **Domain-Aware Adversarial Level Selection for Multi-Scene RL**  
Supervisor: *Prof. Liang Zheng* Jul' 20–Nov' 20
  - Developed an adversarial level selection strategy for achieving **better sample complexity and episode rewards** on multi-scene environments like OpenAI ProcGen and AI2THOR based visual navigation task.
  - **Reduced the source to domain gap** by using a perpetual RL model for minimizing the KL divergence between sample distributions for the training and validation game level trajectories.
-  **Exploring Semantic and Depth Penalties for Sketch Generation**  
Research Project with *Dr. Dylan Campbell* Jul' 20–Nov' 20
  - Used model-based RL with a novel depth variance penalty to **enhance depth perception** in generated sketches.
  - Designed a semantic entropy reward function to discourage brush strokes traversing multiple object boundaries.
- **Connected Stories of Australia: Project with National Museum of Australia**  
Supervisor: *Prof. Emmaline Lear* Jul' 19–Nov' 19
  - Developed a machine learning and design thinking based solution for improving organisation of historic artifacts within NMA's database and increase the outreach of their public API.
  - The final prototype poses as an online interactive treasure hunt, with an NLP based backend for learning sparse concept associations.
-  **Finetuning CNNs using Neural Activation Data**  
Independent Study: *IIT Delhi* Jul' 16–Jun '17 & Jan' 19–May' 19

- Demonstrated significant correlation between **representational dissimilarity matrices (RDM)** for **IT cortex activations** and higher-order CNN features.
- Showed the importance of inter-class correlations between model features for popular CNN architectures.
- **Improved the linear SVM accuracy** for penultimate layer features from the Squeezenet model by **9.86 %** on the Cadieu dataset using a novel RDM loss finetuning approach.

### Face Detection and Recognition

- *Undergraduate Thesis: IIT Delhi*  Jul' 16–May' 17
  - Proposed a novel face recognition approach which uses **Spatial Transformer Networks** along with traditional Facenet pipeline in order to introduce translational and rotational invariance for input images. This resulted in an **improvement of 1.37%** in accuracy over the Facenet model.
  - Came up with a unique approach to **combine 3D facial reconstruction and face recognition** in an end to end pipeline, in order to account for the variations in 3D structure and facial pose.






## Relevant Courses

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- Advanced Topics in Machine Learning (Convex & Differentiable Optimization) Class rank: 1
- Statistical Machine Learning (Bayesian Neural Networks) Class rank: 1
- Advanced Topics in Computer Vision (Research Oriented Course) Class rank: 1
- Advanced Topics in Mechatronics (Computer Vision and Deep Learning)

## Open Source RL Implementations

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-  **Quadcopter Flight Control:** Trained a quadcopter to fly using **Actor-Critic** based **Deep Deterministic Policy Gradients (DDPG)** algorithm with prioritized experience replay.
-  **Multi-Agent Competition:** Trained a pair of RL agents to play tennis using **Multi-Agent DDPG algorithm**, which leads to robust policies for competitive/cooperative play.
-  **Navigation:** Trained a Deep Reinforcement Learning Agent to navigate an artificial world simulated in the **Unity Environment**. The underlying model is a **Dueling Double Deep Q Network with prioritized experience replay**.
-  **Robotic Arm Control:** Trained a robotic arm to reach target locations using **Proximal Policy Optimization (PPO)** algorithm, with multiple (non-interacting, parallel) copies of the same agent to distribute the task of gathering experience.
-  **Alphazero for Tictactoe:** Implemented the alphazero algorithm for the game of Tictactoe. Extended the solution to a much more complex 6-6-4 tictactoe.

## Technical Skills

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- **Programming Languages and Tools:** Python, Java, C++,  $\text{\LaTeX}$
- **Deep Learning Frameworks:** Pytorch, Tensorflow, Caffe, Caffe2
- **Big Data:** Hadoop, Hive, SQL, Teradata
- **Web Development:** HTML5, CSS, Javascript