KHIMYA KHETARPAL

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EDUCATION:

McGill University — **Sept 2017 - Present**
PhD, Computer Science — Montreal, QC Canada
GPA: 4.0/4.0, Advisor: Doina Precup

University of Florida — **Aug 2014 - May 2016**
Master of Science, Computer Engineering — Gainesville, FL,USA
GPA: 3.74/4.0, Advisor: Eakta Jain

Vellore Institute of Technology — **July 2007 - May 2011**
B. Tech, Electronics and Communication Engineering — Vellore, TN, India
GPA: 8.96/10.0

SELECTED PUBLICATIONS (A full list is available on Google Scholar) :

- **Khimya Khetarpal**, Zafarali Ahmed, Gheorghe Comanici, David Abel, Doina Precup. "A Theory of Affordances in Reinforcement Learning" *International Conference on Machine Learning (ICML) 2020.* (**Featured** in MIT Technology Review)

- **Khimya Khetarpal**, Martin Klissarov, Maxime Chevalier-Boisvert, Pierre-Luc Bacon, Doina Precup. "Options of Interest: Temporal Abstraction with Interest Functions" *In Proceedings of the AAAI Conference on Artificial Intelligence (AAAI) 2020.*

- David Abel, Nathan Umbanhowar, **Khimya Khetarpal**, Dilip Arumugam, Doina Precup, Michael L. Littman. "Value Preserving State Action Abstractions" *International Conference on Artificial Intelligence and Statistics (AISTATS) 2020*

- **Khimya Khetarpal**, and Doina Precup. "Learning Options with Interest Functions " *In Proceedings of the AAAI Student Abstract and Poster Program 2019* (**Selected as a finalist in 3 Minute Thesis Competition**)

- **Khimya Khetarpal**, and Doina Precup. "Learning Generalized Temporal Abstractions Across Both Action and Perception" *In Proceedings of the 24th AAAI/SIGAI Doctoral Consortium (DC) at AAAI 2019*

- **Khimya Khetarpal**, and Doina Precup. "Attend Before you Act: Leveraging human visual attention for continual learning." In *Lifelong Learning: A Reinforcement Learning Approach Workshop (ICML) 2018* (**Best Paper Award:** Top 3 papers out of 16 accepted papers).

- Arushi Jain*, **Khimya Khetarpal***, and Doina Precup. "Safe Option-Critic: Learning Safety in the Option-Critic Architecture." In *Adaptive Learning Agents Workshop, (ICML) 2018*. Under submission for consideration to be published in a special issue of *The Knowledge Engineering Review* (Cambridge University Press journal).

- **Khimya Khetarpal***, Zafarali Ahmed*, Andre Cianflone, Riashat Islam, and Joelle Pineau. "RE-EVALUATE: Reproducibility in Evaluating Reinforcement Learning Algorithms." In *Reproducibility in Machine Learning Workshop, (ICML)* (2018).

- Thirunarayanan Ishwarya, **Khimya Khetarpal**, Sanjeev Koppal, Olivier Le Meur, John Shea, and Eakta Jain. "Creating segments and effects on comics by clustering gaze data." *ACM Transactions on Multimedia Computing, Communications, and Applications (TOMM)*, (2017).

- **Khimya Khetarpal**, and Eakta Jain. "A preliminary benchmark of four saliency algorithms on comic art." , *IEEE International Conference on Multimedia & Expo Workshops (ICMEW)*, (2016).

- Awhan Patnaik, **Khimya Khetarpal**, and Laxmidhar Behera. "Mobile robot navigation using evolving neural controllers in unstructured environments." *Advances in Control and Optimization of Dynamical Systems*, *IFAC Proceedings* (2014).

TALKS:

- Reinforcement Learning Lecture - *AI4Good Summer Lab*, Montreal (2020)

- A Theory of Affordances in Reinforcement Learning *RL-Sofa* Mila Montreal (2020), *Google Brain-DeepMind Tea Talk,* Montreal (2019)

- Options of Interest: Temporal Abstraction with Interest Functions- Spotlight Presentation, *AAAI New York* (2020), *DeepMind* Montreal (2019), *RL-Sofa* Mila Montreal (2019)

- Introduction to RL - Invited Lecture *IVADO/MILA Summer School on Deep Learning,* Montreal (2019)

- Function Approximation in RL - *AI4Good Summer School,* Montreal (2019)

- Learning Options with Interest Functions - 3 Minute Thesis (3MT) Competition Finalist - *AAAI Student Abstract and Poster Program at AAAI* (2019)

- Learning Generalized Temporal Abstractions Across Both Action and Perception - *24th AAAI/SIGAI Doctoral Consortium (DC) at AAAI* (2019) Mentor: Michael Littman

- Attend Before you Act: Leveraging human visual attention for continual learning - In *Lifelong Learning: A Reinforcement Learning Approach Workshop, ICML,* Stockholm Sweden. (2018) (Oral Presentation).

- Introduction to Computer Vision : Invited talk at the *Second Informative Talks on Technical Topics* (ITTT) organized by McGill IEEE Student Branch, Montreal, Canada (2018).

- Learning Visual Representations : Invited talk at the *ASU Active Perception Group* Seminar Series organized by Prof. Yezhou Yang, Phoenix, USA (2017).

- Empowering high school girls in STEM : Invited talk at the *Women in Deep Learning* event , Deep Learning Summer School, University of Montreal, Canada (2016).

- A preliminary benchmark of four saliency algorithms on comic art: *IEEE International Conference on Multimedia & Expo Workshops (ICMEW)*, Seattle, USA (2016).

EXPERIENCE:

McGill University **Jan 2020 - May 2020**

Teaching Assistant *(Course: Reinforcement Learning)* Montreal, QC, Canada

- Teaching assistant for a graduate level course alongside. Design homework assignments and hold office hours to ensure students understand concepts.

DeepMind **July 2019 - Dec 2019**

Ph.D. Research Intern *(Mentor: Doina Precup, Gheorghe Comanici)* Montreal, QC, Canada

- Conducted research on understanding affordances in RL, including formulation, analysis and empirical investigation on how affordances could help in speeding up planning and learning for RL agents. This work is submitted and currently under review.

AI4Good Summer School, Mila-McGill University (Link) **June 2018 - July 2018**

Teaching Assistant *(Course: Machine Learning)* Montreal, QC, Canada

- Co-taught lab sessions and a few classes on concepts in machine learning and in particular reinforcement learning to a class of 30 women participants. Currently supervising some of the participants from the summer school to submit their work to undergraduate research forums and workshops.

Intel Corporation **July 2016 - June 2017**

Perceptual Computing Software Engineer *(Mentor: Farshad Akbhari)* Chandler, AZ USA

- Algorithm development for multi-class object recognition with application to driverless cars. My work primarily focused on achieving generalization accuracy for pedestrian detection on various road conditions, employing boosting algorithms in a scalable optimized fashion.

Human Centered Computing Lab **Jan 2016 - June 2016**

Research Scholar – Independent Study *(Mentor: Eakta Jain)* Gainesville, FL USA

- Pursued research work in the field of visual saliency; understanding and learning to predict where humans look, encompassing human gaze data.

Intel Corporation **May 2015 - Dec 2015**

Perceptual Computing Software Intern *(Mentor: Farshad Akbhari)* Chandler, AZ USA

- Contributed to the development of a Pedestrian Detection use case for Advance Driver Assist.
- Developed code for fusing sensor data (RADAR and Camera) for localization.

Machine Intelligence Laboratory **Aug 2014 - Apr 2015**

Research Scholar *(Mentor: Eric Schwartz)* Gainesville, FL USA

- Active member of the software development team, working on Propagator – UF's underwater boat robot to develop software for the path planning algorithm on simulation and actual robot, gaining working knowledge of ROS via a Linux platform.

Indian Institute of Technology, Kanpur **Jan 2013 - July 2014**

Research Associate - *(Mentor: Laxmidhar Behera)* Kanpur, India

- Performed a comprehensive study of genetic, neural and fuzzy-logic based learning algorithms for mobile robot navigation in unknown environments.
- In a team of two, contributed to the design and implementation of a controller using a single and multi-objective evolutionary framework for mobile robot navigation in unstructured environments using tools such as Player/Stage robot simulator, OpenCV and Pioneer 2D-X robot platform.

Robert Bosch Engineering & Business Solution Ltd **July 2011-Dec 2012**

Software Engineer - *(Mentor: Venkatesh Prasad)* Bangalore, India

- Contributed to the Commercial Vehicle Platform (CVP) team, involved in embedded software development for customers like Fiat, Ford, and Navistar
- As a member of the technical team, contributed to requirement analysis, design, coding and testing phases of software development for engine ECUs

Delphi TCI - TIFAC India **Dec 2010 - Apr 2011**

Project Intern - *(Mentor: Sasi Kumar)* Vellore, India

- As a member of a small team, I contributed to the design and implementation of a device driver to transmit the acquired data from radar to a vehicle data logger and replay-back for performance analysis and optimization for on-road scenarios.

AWARDS AND HONORS:

- Selected as a participant for *Science Storytelling* with Confabulation and Broad Science, McGill University, 2020.
- Finalist, Three Minute Thesis (3MT) Competition - "Learning Options with Interest Functions" *AAAI Student Abstract, AAAI* (2019)
- Selected as a presenter in *24th AAAI/SIGAI Doctoral Consortium (DC) at AAAI* (2019) with an award of scholarship.
- Best Paper Award - 3rd Price for "Attend Before you Act: Leveraging human visual attention for continual learning." *In Lifelong Learning: A Reinforcement Learning Approach Workshop, ICML* (2018)
- Student Volunteer Award - ICML 2018.
- CIDSE Doctoral Fellowship Award - Award for the first year of study to pursue a PhD degree in Computer Science at Arizona State University (Declined) , 2017.
- Graduate Research Assistantship Award Award- Award to pursue a PhD degree in Computer Science at the University of Florida (Declined), 2017.
- Academic Achievement Award in the form of a partial fee waiver – University of Florida, 2014.
- Nominated for the 'Best Outgoing Student Award' at VIT University – 6 out of 300 students, 2011.
- Merit scholarship VIT University – 1 out of 60 students 2008, 2009.
- Achievement award for dedication in the game of basketball at VIT University 2011, 2010.
- Intellectual Award by Dreamz (Education Society) and Amar Ujala (Media Partner), 2005.
- Youth Merit Award at 18th Rotary Jet Science Models Contest, 2004.

ACADEMIC ACTIVITIES AND COMMITTEE SERVICE:

- Reviewer, *ICLR* 2020, *NeurIPS* 2020
- Lead organizer, Breakout session on *Continual Reinforcement Learning*, Unworkshop WiML, *ICML* 2020
- Reviewer, *NeurIPS* 2019 Reproducibility Challenge, *ICLR* 2020.
- Co-Organizer, Workshop on *Lifelong Learning: A Reinforcement Learning Approach* (LLARLA), RLDM 2019
- Co-Organizer, Workshop on *Multi-Task and Lifelong Reinforcement Learning*, ICML 2019
- Program Committee, *Continual Learning Workshop*, NIPS 2018
- Reviewer, *AI for Social Good Workshop*, NIPS 2018
- Area Chair, Reviewer, *Women in Machine Learning* (WiML), NIPS 2018
- Organizer, AI Safety Reading Group, McGill University, 2017
- Mentor at *Women in Innovation and Artificial Intelligence* event of the McGill Innovation Week, 2017
- Judge, Engineering Projects in Community Service, Arizona State University, 2017

- Mentor, FIRST Robotics Competition (Gainesville), 2016
- Volunteer & Student Member - ISTE – VIT Chapter, July 2007 - 2008
- Volunteer - Red Cross Youth – VIT Chapter, July 2007

SELECTED PROJECTS:

Leveraging Human Visual Attention for Continual Learning **RLLab, Jan – June 2018**

This work explored leveraging where humans look in an image as an implicit indication of what is salient for decision making. It builds on top of UNREAL agent in DeepMind Lab's 3D maze navigation environment. We train the agent both with original images and foveated images, which are generated by overlaying the original images with saliency maps. We demonstrate that knowing where to look in an image aids continual learning.

Safe Option-Critic **RLLab, Jan – May 2018**

We explore a constrained optimization approach and introduce a notion of safety in learning agents. Previous research has explored such methods for primitive action. In this work, we introduced notions of safety such as reduction in the variance of return in temporal abstractions as opposed to primitive actions.

Multi Class Object Recognition **Intel, July 2016 – June 2017**

Algorithm development for multi-class object recognition for self-driving cars. My work primarily focused on achieving generalization accuracy for detecting people from a moving car camera, employing boosting algorithms in a scalable optimized fashion.

Visually attended locations using a Winner-Take-All Neural Network **UF, May – June 2016**

Generated visually attended locations in comic images via a combination of saliency maps and a Winner-Take-All neural network. Experiments were performed with different hyper parameters to visualize the effects of inhibition of-return around chosen salient locations resulting in biologically plausible eye scan paths.

Predicting visual attention in comic art **UF, Jan – Apr 2016**

Evaluated four saliency models for predicting eye fixations in context of comic art. Baseline experiments on eye data from five subjects for comic images were validated by comparison with results on a standard dataset. Performed an exploratory analysis on similarity between comic images and natural images by formulating a similarity metric to quantify this measure.

Pedestrian Detection **Intel, May – Dec 2015**

Training and testing of the Object Recognition pipeline for the use case of Pedestrian Detection in context of ADAS. Owned and developed the entire use case comprising of various datasets generation for feature computations, training, and testing using proposal generation schemes

Pedestrian Detection Using Sensor Fusion **Intel, May – Dec 2015**

Proposed and defined a pipeline for the use case of Pedestrian Detection via sensor fusion using Camera and RADAR for localization and cross validation. Owned and developed the sensor fusion class, involving data synchronization, search-space localization for faster computation.

Parsing English sentences using PROLOG **UF, Feb – Mar 2015**

Implemented a parsing system addressing context free grammar parsing sentences based on grammar rules. The system was able to convert English sentences into predicate calculus, identify different parts of speech, and display parse trees for sentences including active and passive voices, auxiliary verbs, and interrogative sentences such as "Which movies did she see?" . This project was implemented in PROLOG.

Human tracking Autonomous Mobile Robot (AuMoRo) **UF, Aug – Dec 2014**

An autonomous mobile robot designed and programmed to perform human-tracking. The robot can autonomously track human motion and react in accordance, using the integration of on-board vision processing algorithm and an Arduino Due. Obstacle avoidance capabilities also are an essential development in this robot.

Mobile robot navigation in uncertain environments using evolving neural controller **IIT, Jan 2013-May 2014**

Contributed towards the realization of evolving a single neural controller that simultaneously learns obstacle avoidance and target seeking without an explicit behavior switching scheme. We train the robot in a static, unmapped environment consisting of multiple obstacles of different shapes and sizes. We study 4 different training schemes that emphasize the learning objectives differently. The trained controller is validated by simulations across a diverse range of environments different from the training environment. A comparative study of the robot behavior under different objective functions has been done. We discuss the performance measured on the basis of several metrics

Autonomous Tank Bot **IIT, Jan – May 2014**

Built an autonomous tank robot from scratch with an on-board Arduino controller. Programmed in the Arduino environment, to successfully navigate a course of obstacles. This was a hobby project, built over a period of 3 days in a team of two at Indian Institute of Technology, Kanpur.

COURSEWORK:

- **Graduate Coursework:** Lifelong Reinforcement Learning, Reinforcement Learning, Math in Machine Learning, Scientific Computing, Pattern Recognition, Image Processing & Computer Vision, Intelligent Machines Design Laboratory, Elements of Machine Intelligence, Stochastic Methods II, Machine Intelligence, Software Engineering
- **Selected Undergraduate Coursework:** Digital Image Processing, Probability Theory and Random Processes, Digital Signal Processing, Data Structures and Algorithms, Engineering Mathematics II, Calculus and Analysis, Modern Physics, Network Theory, Engineering Drawing, Computer Architecture and Organization
- **MOOC:** Machine Learning – Stanford University , Control of Mobile Robots – Georgia Tech

TECHNICAL SKILLS:

Languages: Python, Matlab, Latex, Assembly Level Language, C, C++
Tools: Git, Makefiles, Pytorch, Tensorflow
Robotic Platforms: PIONEER 2D-X, UF's autonomous surface vehicle Propagator