

Deepali Jain

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RESEARCH INTERESTS

Reinforcement Learning, Sequential Decision Making, Knowledge Representation and Reasoning

EDUCATION

Indian Institute of Technology Roorkee
Bachelor of Technology in Electrical Engineering

Roorkee, India
2012 – 2016

RESEARCH/INDUSTRY EXPERIENCE

Google Research and Machine Intelligence, AI Resident
Adobe Research, Big-Data Experience Lab, Research Fellow
Adobe Research, Big-Data Experience Lab, Research Intern
Google Summer of Code, Wikimedia, Open-Source Developer

July 2018 - Present
June 2016 - July 2018
May 2015 - July 2015
May 2014 - August 2014

PUBLICATIONS

Hierarchical Reinforcement Learning for Quadruped Locomotion

D. Jain, A. Iscen, K. Caluwaerts
Submitted to International Conference on Intelligent Robots and Systems 2019

Surveys without Questions: A Reinforcement Learning Approach

A. Sinha, **D. Jain**, N. Sheoran, S. Khosla, R. Sasidharan
Association for the Advancement of Artificial Intelligence 2019

Measurement of Users' Experience on Online Platforms from their Behavior Logs

D. Jain, A. Sinha, N. Sheoran, D. Gupta, S. Khosla
Pacific-Asia Conference on Knowledge Discovery and Data Mining 2018

An LSTM Based System for Prediction of Human Activities with Durations

K. Krishna*, **D. Jain***, S. Mehta, S. Choudhary (* Equal contribution)
PACM-Interactive, Mobile, Wearable and Ubiquitous Technologies, UbiComp 2018

Fairness Aware Recommendations on Behance

N. Modani, **D. Jain**, U. Soni, G. K. Gupta, P. Agarwal
Pacific-Asia Conference on Knowledge Discovery and Data Mining 2017

POSTER PRESENTATIONS

Hierarchical Reinforcement Learning Framework for Legged Locomotion

D. Jain, A. Iscen, K. Caluwaerts
Annual Machine Learning Symposium, The New York Academy of Sciences, 2019

PATENT APPLICATIONS

Predictive Analysis of User Behavior utilizing RNN-based User Embedding

S. Kim, C. Chen, H. Bui, E. Koh, B. Kveton, **D. Jain**, A. Sinha, D. Gupta, N. Sheoran (*US Patent App. 15/814,979. Filed 17 November 2017*)

Creator Aware and Diverse Recommendations of Digital Content

N. Modani, **D. Jain**, U. Soni, G. K. Gupta, P. Agarwal (*US Patent App. 15/598,193. Filed 16 June 2017*)

Personalized Creator Recommendations

N. Modani, **D. Jain**, U. Soni, G. K. Gupta, P. Agarwal (*US Patent App. 15/625,237. Filed 17 May 2017*)

RESEARCH PROJECTS

SEQUENTIAL DECISION MAKING

Hierarchical Reinforcement Learning for Quadruped Locomotion

Submitted

Legged locomotion is a challenging task for learning algorithms, especially when the task requires a diverse set of primitive behaviors. To solve these problems, we introduce a hierarchical framework to automatically decompose complex locomotion tasks. A high-level policy issues commands in a latent space and also selects for how long the low-level policy will execute the latent command. Concurrently, the low-level policy uses the latent command and only the robot's on-board sensors to control the robot's actuators. Our approach allows the high-level policy to run at a lower frequency than the low-level one. We test our framework on a path-following task for a dynamic quadruped robot and we show that steering behaviors

automatically emerge in the latent command space as low-level skills are needed for this task. We then show efficient adaptation of the trained policy to a different task by transfer of the trained low-level policy. Finally, we validate the policies on a real quadruped robot. To the best of our knowledge, this is the first application of end-to-end hierarchical learning to a real robotic locomotion task.

Measurement of Users' Experience on Online Platforms from their Behavior Logs

Published

Users' behavior on an online platform is modeled as a partially observed Markov decision process (POMDP). User experience (UX) is measured as a latent variable represented by the value function in the POMDP.

- Implemented environment simulation using next action prediction model. Average F1 score: 47%.
- A function approximation based fixed point iteration method is implemented to compute UX.
- Formalized another rule-based approach informed by consumer psychology as a benchmark.
- Evaluation of the method provides evidence that estimated values are relevant metrics of UX (69% F1 score on conversion prediction). The proposed approach can overcome deficiencies of traditional survey methods for experience measurement.

An LSTM Based System for Prediction of Human Activities with Duration

Published

Two RNN architectures for joint prediction of human activities and their duration are proposed.

- Designed an activity data collection experiment and created an [Android application](#) for the same.
- Designed a Recurrent Neural Network (RNN) architecture that shows 20% higher accuracy (47.6% on 21 class classification) than the best baseline.
- Developed a probabilistic sequence matching algorithm and implemented a string alignment algorithm inspired from gene and protein sequence mining research as comparison baselines.
- Implemented and compared methods of sequence generation from RNN for modeling complete days.
- Designing a multi-goal RL agent to suggest changes to the daily routine of a subject. Objective is to achieve certain productivity goals with minimum disruption in regular activities.

OTHER RESEARCH

Fairness Aware Recommendations on Behance

Published

- A re-ranking strategy was proposed that can be applied to the scored recommendation lists to improve exposure distribution across the content creators on two-sided platforms (thereby improving the fairness), without unduly affecting the relevance of recommendations provided to the consumers.
- Implemented a scalable Apache Spark application for item similarity based collaborative filtering algorithm. Also implemented a greedy optimization based reranking algorithm for making the collaborative filtering based recommendations fair and diverse.
- Carried out experimentation to show that our method resulted in recommendations with much higher level of fairness (70%) and representative diversity (130%) compared to the state-of-art recommendation strategies, without compromising the relevance score too much.

Blind Source Separation of Audio Signals

B.Tech. Project

BSS is the problem of separating mixed signals from unknown sources.

- Conducted a comparative study of the existing higher-order statistical signal processing solutions to the Blind Source Separation (Cocktail Party) problem such as Independent Component Analysis, Singular Value Decomposition and Multiple De-correlation.
- The accuracy as well as efficiency results obtained from same experiments on different methods were documented, showing limitation of existing methods in separation of real-world audio signals due to convolutive effect of sound reverberation.

SELECTED PROJECTS

Human-Computer Interface using Electroencephalography Signal Classification

Aug - Nov 2015

Recorded EEG signals were pre-processed through Common Spatial Pattern filter and a binary SVM classification model was trained on the samples to predict motor imagery classes (left/right hand movement).

Context-Aware Media Content Analysis

May - Jul 2015

Built an end-to-end physical activity recognition system based on accelerometer data from mobile sensors. Tested the hypothesis that different context of readers leads to different choice of media articles, using click-stream data analysis.

Adler: Text Classification API based on TechTC-300 Test Collection

Feb - Apr 2016

Developed a ready-to-use text corpus generation engine as an open source python package. The final dataset used chi-squared feature selection and TF-IDF feature weighting. Classification of text into various topics based on extracted features was performed using a Decision-Jungle classifier in AzureML Studio.

Raphael: Classification of Paintings based on Style and Era

Apr - May 2015

Artificial Neural Networks Course Project under Prof. G.N. Pillai. Built a system to classify paintings taken from wikiart.com into the era and style they belong to, using low level (color histograms, texture, color saturation) and high level (Scale-Invariant Feature Transform (SIFT) descriptors, Speeded-Up Robust Features (SURF)) image features. The extracted features were quantized using K-means clustering and bag-of-visual-words method. An ensemble of SVM, Feed-forward Neural Networks and Random Forests were used for prediction of painting style and era.

Forsit: Hybrid Recommendation System for Mathematical Problem-Solving Website

Aug 2015

Winning entry for Ideaz Paper Presentation contest. Built a recommendation engine for a [mathematical problem-solving platform](#) developed by SDS Labs at IIT Roorkee, using a hybrid of content based and collaborative filtering methods.

Xavier: Knowledge Representation of PDF Document Content

Sep 2015

Built a python module for extracting structured information from a set of PDF documents. The documents were scraped and their content was parsed to extract the document structure as the first step. Then, important entities and relations between them were identified with the help of structure information and Entity Recognition.

Book Management Software for Wikibooks

May - Aug 2014

Google Summer of Code project. Worked on a PHP and Javascript based extension, BookManager, for Mediawiki software under Wikimedia organization. Created a robust and user-friendly interface for editing, reading, navigation and migration of large Wikibooks (~ 10,000 sections).

AWARDS AND ACHIEVEMENTS

Winner, Microsoft Code.Fun.Do, IIT Roorkee

2015

National Finalist, GSQuantify Data Science Challenge, Goldman Sachs

2015

Winner, Ideaz Paper Presentation Contest, IIT Roorkee

2015

National Winner, IEEE Programming League

2015

Air Cmde S.C. Mehra Scholar, IIT Roorkee

2012

Best academic performance by woman student in Electrical Engineering

Kishore Vaigyanik Protsahan Yojana Fellow

2012

High school student with talent and research aptitude for higher studies

National Talent Search Scholar

2008

RELEVANT COURSEWORK

Undergraduate: Linear Algebra, Multivariate Calculus, Partial Differential Equations, Transform Theory, Numerical Methods, Artificial Neural Networks, Discrete Mathematics, Mathematical Modeling, Digital Signal Processing

Independent: Reinforcement Learning (Udacity), Deep Reinforcement Learning (UCB), Probabilistic Graphical Models (Coursera), Game Theory (Coursera), Introduction to Machine Learning (Coursera), Deep Learning (Udacity)

TECHNICAL SKILLS

Machine Learning: TensorFlow, Keras, Apache Spark, Python Scipy stack, R, Theano, Torch, Caffe, GNU Octave, MATLAB

Programming Languages: Python, C++, Java, PHP, JavaScript

Misc.: Bash, Git, Android Development, ReactJS, NodeJS, Django, SQL, \LaTeX

POSITIONS OF RESPONSIBILITY

Developer, SDS Labs, IIT Roorkee

2013 - 2016

Coordinator, Programming and Algorithms Group, IIT Roorkee

2014

Chief Web Coordinator, Watch Out News Agency, IIT Roorkee

2014