KANAV VATS

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EDUCATION

University of Waterloo Ph.D in Systems Design Engineering Thesis topic: *Player tracking and identification in ice hockey*. GPA: 85.3/100

Indian Institute of Technology (IIT) Roorkee

Integrated Master of Science in Applied Mathematics Thesis topic: Pose Estimation in ice hockey using deep Convolutional Neural Networks. GPA: 81.6/100

EXPERIENCE

Stathletes, Canada

Mitacs accelerate intern

- Designed and implemented an automated computer vision system to track and identify ice hockey players in broadcast video with an accuracy of $\sim 90\%$.
- Worked on various problems in the realm of computer vision based sports analytics including **2D** human pose estimation, sports event detection, player action recognition and ball/puck localization.
- Published computer vision based sports analytics research papers in various conferences including **CVPR**, **AAAI**, **ACM Multimedia**, **CRV** and peer-reviewed journals.

University of Waterloo, Canada

Visiting researcher

- Implemented a novel convolutional neural network to estimate hockey player and stick pose from images obtaining an accuracy of more than $\sim 95\%$.
- Developed an application to annotate and store human joint coordinate locations in images to be used in pose estimation algorithms.
 - Built two versions of the application, a standalone python-based web application and another version deployed on Amazon Mechanical Turk (AMT).

University of Waterloo, Canada

Teaching assistant

- Worked as a teaching assistant (TA) for three courses Introduction to Pattern Recognition, Data Structures & Algorithms and Digital Computation.
- Prepared course material, assignments and quizzes.
- Gave tutorial lectures and assisted students with the course material.

Accenture Digital, Bangalore, India

Summer internship

- Applied and compared several machine learning models like **XGBoost**, **Artificial Neural Networks**, **Random Forests**, **Support Vector Machines** etc for predicting whether a customer of a Telecom company needs service in a given time frame in future.
- Built an analytics dashboard application from scratch using **R Shiny** for descriptive data analysis and data visualization.
- Performed customer volume forecasting using ARIMA and DNN models such as Feedforward Neural Networks and Recurrent Neural Networks.

Dec 2017 - April 2018

2013 -2018

2018 - present

May 2019 - present

Jan 2019 - present

May 2017 - July 2017

Juspay, Bangalore, India

Summer internship

- Worked on API development using node.js.
- Analysed user dropout time and OTP flow for various banks and merchants.
- Performed data visualization using sankey flow diagrams for getting an insight into user behaviour.

Blinkit, Gurgaon, India

Summer internship

- Calculated retention rate of customers and classified users according to their cities.
- Worked on push-notifications on android and ios; sent automated time dependent notifications to users according to their geographical location.
- Made automated reports for the marketing team involving extensive use of relational and non relational databases.

Information Management Group (IMG), IIT Roorkee

Chief - security and system administration.

- IMG is a student group involved in the development and maintenance of campus intranet facilities for students and faculties.
- Developed Buy and Sell one the most used campus intranet web application. Buy and sell provides the students of IIT Roorkee a platform to buy and sell products like books, electronic goods etc. The application was built with **python django web framework**.
- Contributed in the development of several other web/mobile applications, mentoring juniors and dealing with the administration.

PUBLICATIONS

Journal articles

K. Vats, P. Walters, M. Fani, D. A. Clausi and J. Zelek. Player tracking and identification in ice hockey. 2021, *In Expert Systems with Applications (submitted)*

W. McNally , **K. Vats**, J. McPhee and A. Wong. EvoPose2D: Pushing the boundaries of 2d human pose estimation using accelerated neuroevolution with weight transfer. *IEEE Access*, 2021

Conference publications

K. Vats, W. McNally, P. Walters, D. A. Clausi and J. Zelek. Ice hockey player identification via transformers and weakly supervised learning. In 2022 IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW).

W. McNally, **K. Vats**, A. Wong and J. McPhee. Rethinking Keypoint Representations: Modeling Keypoints and Poses as Objects for Multi-Person Human Pose Estimation, arXiv e-prints, 2021

K. Vats, M. Fani, D. A. Clausi, J. Zelek. Multi-task learning for jersey number recognition in Ice Hockey. *Proceedings* of the 4th International Workshop on Multimedia Content Analysis in Sports, 2021.

K. Vats, M. Fani, D. A. Clausi, J. Zelek. Puck localization and multi-task event recognition in broadcast hockey videos. In 2021 IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW).

W. McNally, P. Walters, K. Vats, A. Wong, J. McPhee. DeepDarts: Modeling Keypoints as Objects for Automatic Scorekeeping in Darts Using a Single Camera. *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*, 2021

K. Vats, M. Fani, P. Walters, D. A. Clausi and J. Zelek. Event detection in coarsely annotated sports videos via parallel multi receptive field 1D convolutions. In 2020 IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW).

May 2015 - July 2015

Jan 2014 - June 2018

K. Vats, W. McNally, C. Dulhanty, Zhong Q. Lin, D. A. Clausi and J. Zelek. PuckNet: Estimating hockey puck location from broadcast video. In AAAI-20 Workshop on Artifical Intelligence in Team Sports, AAAI 2020, New York, USA.

W. McNally, **K. Vats**, T. Pinto, C. Dulhanty, J. McPhee and A. Wong. GolfDB: A Video Database for Golf Swing Sequencing. In 2019 IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW).

Z. Cai, H. Neher, **K. Vats**, D. A. Clausi and J. Zelek. Temporal Hockey Action Recognition via Pose and Optical Flows. In 2019 IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW).

D. Kumar, I. B. Daya, **K. Vats**, J. Feng, A. Wong and G. Taylor. Beyond Explainability: Leveraging Interpretability for Improved Adversarial Learning. In 2019 IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW).

K. Vats, H. Neher, D. A. Clausi and J. Zelek. Two-stream Action Recognition in Ice Hockey using Player Pose Sequences and Optical Flows. In 16th Conference on Computer and Robot Vision (CRV), 2019.

M. Fani, K. Vats, C. Dulhanty, D. A. Clausi and J. Zelek. Pose-projected Action Recognition Hourglass Network (PARHN) in Soccer. In 16th Conference on Computer and Robot Vision (CRV). 2019.

K. Vats, H. Neher, A. Wong, D. A. Clausi and J. Zelek. KPTransfer: improved performance and faster convergence from keypoint subset-wise domain transfer in human pose estimation. In *Image Analysis and Recognition: 16th International Conference, ICIAR 2019*, Waterloo, Canada

H. Neher, **K. Vats**, A. Wong, and D. A. Clausi. HyperStackNet: A hyper stacked hourglass deep convolutional neural network architecture for joint player and stick pose estimation in hockey. In 15th Conference on Computer and Robot Vision (CRV), Toronto, Canada, 2018.

SKILLS

Languages	Python, C++, R, SQL
Frameworks	Pytorch, Git, Latex, Tensorflow, Keras
Web Technologies	HTML, CSS, Javascript, Node.js, Django

RELEVANT COURSES

SYDE-770: Deep Learning
SYDE-672: Statistical Image Processing
MAN-102: Linear Algebra
MAN-326: Numerical Optimization
MAN-507: Statistical Inference
MAN-106: Data Structures
MAN-205: Design and Analysis of Algorithms
IEE-303: Artificial Neural Networks

MEDIA

- Waterloo researchers introduce new hockey statistics tracking system, The Charlatan, November 2021
- Artificial intelligence makes it faster, easier to analyze hockey video, University of Waterloo News, October 2021

AWARDS

- International Doctoral Student Award by University of Waterloo.
- Innovation in Science Pursuit for Inspired Research (INSPIRE) fellowship by Government of India.
- Mukhyamantri Protsahan Yojana (MMPY), a one time award of 75000 rupees issued by government of the state of Himachal Pradesh, India for meritorious students pursuing higher education in engineering.