

# Đorđe Božić

🌐 <https://bozic-djordje.github.io/>  
✉ [djordjebbozic@gmail.com](mailto:djordjebbozic@gmail.com)  
☎ +44 7534 260 015  
📍 BA2 3HL Bath, United Kingdom

## ABOUT

I am a machine learning engineer with five years of experience in the industry, currently doing a PhD at the Bath Reinforcement Learning Laboratory under the supervision of professor Özgür Şimşek. My main research focus is learning useful representations for generalisation and knowledge transfer in Reinforcement Learning (RL). I was looking into this topic through the lens of hierarchical and intrinsically motivated RL during my masters, while my current research is focused on symbol grounding and constructing multimodal representations for RL.

**Research interests:** reinforcement learning, symbol grounding, multimodal learning, world models, continual learning, hierarchical RL, intrinsic motivation

## EDUCATION

<b>PhD, Accountable, Responsible, and Transparent AI</b> <i>Department of Computer Science, University of Bath</i>	<b>2024 –</b>
<b>MSc, Accountable, Responsible, and Transparent AI</b> <i>Department of Computer Science, University of Bath</i>	<b>2023 – 2024</b>
<b>MEng, Applied Mathematics</b> <i>School of Electrical Engineering, University of Belgrade</i>	<b>2019 – 2021</b>
<b>BEng, Computer Engineering and Informatics</b> <i>School of Electrical Engineering, University of Belgrade</i>	<b>2013 – 2019</b>

## PAPERS

- Đorđe Božić, Predrag Tadić, Mladen Nikolić, Intrinsically motivated option learning: a comparative study of recent methods, 29th Telecommunications forum TELFOR 2021, Belgrade, Serbia, 2021

## ACADEMIC PROJECTS

<b>Grounding Language via Successor Features for Generalisation in RL</b> <i>Ongoing research project under the supervision of professor Özgür Şimşek</i> <ul style="list-style-type: none"><li>◦ Implemented tabular versions of successor features for both on-policy and off-policy RL algorithms.</li><li>◦ Extended Taxicab environment to support goals described in natural language and feature-based states.</li><li>◦ Currently in the process of implementing function-approximated successor features.</li></ul> <b>Keywords:</b> successor features, gated multimodal fusion, symbol grounding	<b>2025</b>
<b>Obstacle avoidance algorithm for the ROSbot car</b> <i>Final project in the robotics software masters course</i> <ul style="list-style-type: none"><li>◦ Implemented the obstacle avoidance algorithm based on a finite state machine in Robot Operating System (ROS) for the agent with LiDAR and proximity sensors.</li><li>◦ Earned second place in the course-wide obstacle avoidance competition.</li></ul> <b>Keywords:</b> ROS, robotics, real-time navigation	<b>2024</b>
<b>The Options Framework in Reinforcement Learning</b> <i>Masters thesis under the mentorship of professor Predrag Tadić and professor Mladen Nikolić</i> <ul style="list-style-type: none"><li>◦ Surveyed the application of options in the presence of extrinsic rewards and unsupervised RL.</li><li>◦ Explored various information-theoretic goals that can be used in unsupervised RL, with special focus placed on the concept of <i>empowerment</i>.</li><li>◦ Implemented Soft Actor Critic (SAC) and Option Critic (OC). Implemented SAC-based OC.</li><li>◦ Implemented Diversity Is All You Need (DIAYN) and applied it to continuous control environments.</li><li>◦ Published a survey paper on intrinsically motivated skill learning in unsupervised RL using empowerment.</li></ul>	<b>2021</b>

**Keywords:** options framework, skills, empowerment, intrinsic motivation

## **The Effect of Memory in Partially Observable Environments**

**2020**

*Final project in the neural networks masters course*

- Implemented Deep Q-Learning (DQN) and Double Deep Q-Learning (DDQN) architectures with Long Short Term Memory (LSTM) following instructions from Deep Recurrent Q-Learning (DRQN) paper.
- Modified a fully observable environment (MDP) to a partially observable one (POMDP), and compared the performance of DQN and DRQN agents across both environments.

**Keywords:** DQN, DDQN, LSTM, POMDP, DRQN

## **Intrinsic Motivation and Curriculum Learning with Policy Optimization**

**2019**

*Final project in the machine learning masters course*

- Trained Proximal Policy Optimisation (PPO) utilising Generalised Advantage Estimation (GAE) on curiosity-inspired intrinsic rewards derived from self-supervised prediction.
- Experimented with curriculum learning on a partially observable environment with scarce rewards.

**Keywords:** policy optimization, PPO, GAE, curiosity, curriculum learning

## **Fall Detection Using Optical Flow**

**2019**

*Bachelors thesis under the mentorship of professor Goran Kvaščev*

- Built a real-time CPU inference-capable fall detector.
- Used a CNN feature extractor and the transformer decoder to classify fixed-length sequences of optical flow features into actions.
- Used optical flow and single-shot object detectors in data pre-processing to emphasize movement and extract people from the scene.

**Keywords:** action recognition, optical flow, transformers

## **Various Projects**

**2013 – 2017**

*Final projects in various bachelors courses*

- **Thread Synchronization Kernel** [C++]: Implemented a small operating system kernel able to handle threads and synchronous and asynchronous context switching through semaphores and events.
- **Two-pass Assembler** [C++]: Implemented an assembler able to fully translate the reduced instruction set of x86-like assembly language into object files.
- **Micro-Java Compiler** [Java]: Implemented lexical, syntax and semantic analysis part of the compiler, which generated bytecode at the output.
- **X509 Certificate System** [Java]: Implemented the X509 certificate system capable of key-pair generation, certificate-signing request generation and key-pair signing, and exporting X509 certificates.

**Keywords:** thread synchronization, assembler, compiler, cryptography, data security

## **WORK HISTORY**

### **Incode**

**2023**

*Machine learning research engineer*

### **Everseen**

**2021 – 2023**

*Machine learning research scientist*

### **Retail Intelligence LLC**

**2018 – 2019**

*Machine learning research engineer*

## **WORK PROJECTS**

### **Face Spoofing Detector**

**2023**

*Research project at Incode*

- Developed a classifier-based solution to detect wearables aimed at preventing facial recognition.
- The production-ready solution worked across different edge devices, lighting conditions, and angles.
- Had to work with very large and heavily unbalanced datasets.

**Keywords:** classification, facial spoofing, unbalanced datasets

**Self-checkout Vision-based Expert System** **2022**  
*Research project at Everseen*

- Implemented several features of the theft-catching computer vision-based expert system for self-checkout lanes in retail stores.
- Maintained and deployed production code that ran on thousands of devices across dozens of retail chains.

**Keywords:** expert systems, object tracking, production

**Missing Product Detection from Visual Data** **2021**  
*Research project at Everseen*

- Modified known network architectures to support either multi-label classification or regression.
- Experimented with a differentiable F1 loss for multi-label classification.
- Experimented with synthetic data.

**Keywords:** multi-label classification, synthetic data generation, regression

**Detecting Missing Products from Transaction Records** **2021**  
*Research project at Everseen*

- Tried to predict fraudulent transactions with no other context except registered scanned products.
- Created node embeddings based on the co-occurrence of products in transactions.

**Keywords:** graph convolutional networks, node classification, graph clustering

**Suspicious Action Detection** **2019**  
*Research project at Retail Intelligence LLC*

- Used pose estimators coupled with custom-made heuristics and object detection to predict suspicious poses indicative of theft.

**Keywords:** action recognition, pose estimation, Open Pose, Alpha Pose

**Cart State Estimation based on Visual Data** **2018**  
*Research project at Retail Intelligence LLC*

- Used image classification, and later object detection to both localize and identify cart states during the checkout process in retail stores.

**Keywords:** image classification, object detection, single-shot detectors

## ■■■■■ LANGUAGES & FRAMEWORKS

- Languages: Python, C++, C, Java, Matlab, Octave, Pascal, SQL
- Libraries & frameworks: PyTorch, TensorFlow 2, Keras, NumPy, Pandas, Scikit-learn, OpenCV, Matplotlib
- Other tools: AWS Services, ML-Agents, OpenVINO, OpenAI Baselines
- OS: OS X, Linux

## ■■■■■ CONFERENCES

**29th Telecommunications forum TELFOR** **2021**  
*Belgrade, Serbia*

**European Institute of Innovation and Technology (EIT) Digital** **2018**  
*Brussels, Belgium*

## ■■■■■ SUMMER SCHOOL ORGANIZATION

**"Petnica" Summer Institute in Machine Learning** **2021** –  
*Involvement in organization and lectures*

- Responsible for giving a three-hour lecture on RL and holding a workshop focusing on DQN each year.
- Helped in various organisational roles over the years, most notably in preparing the solutions for the entrance exams.

## TEACHING ASSISTANT POSITIONS

<b>Bayesian Machine Learning</b> <i>Undergraduate and postgraduate courses, University of Bath</i>	<b>2025</b>
<b>Artificial Intelligence</b> <i>Undergraduate and postgraduate courses, University of Bath</i>	<b>2024 – 2025</b>
<b>Reinforcement Learning</b> <i>Undergraduate and postgraduate courses, University of Bath</i>	<b>2024</b>
<b>Machine Learning</b> <i>Undergraduate courses, University of Bath</i>	<b>2023 – 2024</b>

## INVITED TALKS

<b>Neural Networks from Scratch Practical Workshop</b> <i>Seminar for Applied Physics and Electronics (PFE), Serbia</i>	<b>2022</b>
<b>Introduction to Reinforcement Learning</b> <i>Google Student Developer Club at the University of Belgrade</i>	<b>2021</b>

## SUMMER SCHOOLS ATTENDED

<b>Machine Learning Summer School (MLSS)</b> <i>Krakow, Poland</i>	<b>2022</b>
<b>Eastern European Machine Learning Summer School (EEML)</b> <i>Vilnius, Lithuania</i>	<b>2022</b>

## EXTRACURRICULAR COURSES & SPECIALIZATIONS

<b>Machine Learning</b> <i>Stanford Online, Coursera</i>	<b>2017</b>
<b>Neural Networks and Deep Learning</b> <i>DeepLearning.AI, Coursera</i>	<b>2017</b>
<b>Improving Deep Neural Networks</b> <i>DeepLearning.AI, Coursera</i>	<b>2017</b>
<b>Convolutional Neural Networks</b> <i>DeepLearning.AI, Coursera</i>	<b>2017</b>

## OTHER ACCOMPLISHMENTS

<b>Managed to quit smoking</b> <i>...after many failed attempts</i>	<b>2021</b>
<b>Competitive fencing</b> <i>As part of the Serbian national team</i> <ul style="list-style-type: none"><li>◦ National champion in the cadet category in Serbia in 2011.</li><li>◦ Bronze medal in the junior category in Serbia in 2011.</li></ul>	<b>2009 – 2012</b>