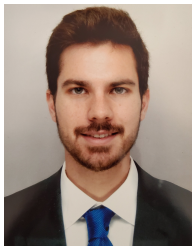

Nathan Corral

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As a Computer Engineer with a master's specialization in Computer Vision and Robotics, I am eager to advance applied automation through state-of-the-art deep learning solutions.

Job Experience

Humanoid Robots Lab – University of Bonn *Research Assistant*
09.2021 – 09.2022 Bonn, Germany

- Contributed to research and publications in personalized robot navigation.
- Programmed the ROS interface for 3D localization of humans from an RGBD camera using deep learning and implemented this on a real robot for autonomous navigation.
- Used the photo-realistic simulator iGibson (PyBullet backend) to generate data for a deep reinforcement learning-based path planning algorithm.
- Setting up and conducting a user study evaluating human-robot-interaction in a VR headset, with a follow-up on real robot hardware.

Head Rush Technologies *Contract Engineer*
12.2019 – 04.2020 Boulder, USA

- Contract was to code the firmware on a ATmega328PB Microchip for a proof-of-concept system.
- Work involved programming an interrupt triggered gear tooth sensor, RS485 communication, a PWM powered brake, and finite state machine logic.
- Completed field tests and project documentation.
- Success from this prototype led to further development, ultimately released as their "Catch-and-Hold Technology".

Aqronos *Software Engineer*
11.2018 – 12.2019 Denver, USA

- Designed ROS nodes for visualization of the company's LiDAR prototype.
- Structured UDP packets and coded both ends of sending and receiving modules.
- Interact with a REST API hosted on the embedded system for configuring hyperparameters.
- Filtered point clouds and grouped objects using the C++ Point Cloud Library.

Creative Edge LLC *Software Engineer*
08.2017 – 09.2018 Denver, USA

- Developed applications for cryptocurrency mining in both Windows and Linux.
- Wrote software managing OS drivers, system configurations, and 3rd party tools.

Education

M.Sc. **University of Bonn** *Computer Science*
10.2020 – 09.2023 Note: 1.7

B.Sc. **University of Illinois Urbana-Champaign** *Computer Engineering*
08.2013 – 05.2017 GPA: 3.55/4.0

Master Thesis

2023 **Stochastic Transformer for Prediction of Multiple Futures**

This thesis builds upon the foundations of Stochastic Video Generation[1] and Variational Transformers[2], expanding their applications into a versatile, task-agnostic, stochastic prediction network. This thesis contributed:

- A novel transformer-based predictor architecture, able to learn a distribution over potential futures.
- Detailed comparison against other stochastic-based models in video prediction, boasting higher structural similarity in frame-wise comparisons.
- Application in the domain of human pose prediction, generating over 8 seconds of continued walking after the initial 0.3 seconds of seed motion.

Projects

2024 **ROS 2 Whisper** Video, Source

As an extension of this open source project, I implemented boarder-less, live audio transcription. My contribution has led to me being an active maintainer in this project. Written in C++, the code emphasizes:

- Scalability, using both inheritance and composition in object-oriented programming behavior.
- Efficiency, through intentional memory management, thread-safe callbacks and work splitting across multiple nodes.
- Simplicity, in the well thought-out implementation of complex merging algorithms.

ROS 2 Computer Vision Video, Source

Running multiple computer vision models (DETR, Maskformer) trained across different datasets/tasks on a live camera feed introduces several implementation challenges. This Python repository presents a solution for:

- Downloading and running state-of-the-art models from Hugging Face as asynchronous ROS 2 nodes.
- Hosting a label server for re-addressing model outputs into a global database.
- Displaying segmentation masks and bounding boxes as a Matplotlib animation.
- Publishing dataset images for repeatable evaluation of CV models.

Semantic Search using Facebook AI Similarity (FAISS) Source

This project implements the first steps in Retrieval-Augmented Generation (RAG) (stopping at "Generation"). I perform web scraping, dataset/query embedding, and similarity scoring to reference data from a natural language query.

Publications

J. de Heuvel, **N. Corral**, et al. "Learning depth vision-based personalized robot navigation from dynamic demonstrations in virtual reality" *IROS*, 2023

Skills

Languages	· English (Native) · German (C1)
Strengths	· Problem Solving · Cross-Team Collaboration · Reliable · Technical Documentation · Hard Working
Coding	· C++ · Python · Bash · C · LaTeX · Java
Software	· Linux/Ubuntu · GitHub · Docker · ROS/ROS2 · QEMU · Hyperstack · AWS EC2

[1] Denton et al., "Stochastic video generation with a learned prior." ICML 2018

[2] Lin et al., "Variational transformers for diverse response generation." arXiv 2020

Skills (continued)

Libraries (C++)	· std · chrono · Point Cloud Library · nlohmann/json · curl
Libraries (Py)	· PyTorch · Hugging Face · TensorFlow · Matplotlib · Pandas · OpenCV · NumPy · scikit-learn
Knowledge	· Agile · REST API · Test-driven Development · POSIX · Object Oriented Programming · Data Structures
Robotics	· Forward/Inverse Kinematics · SLAM · Path Planning · PID / Model Predictive Controllers · Kalman (Bayes) Filters
Deep Learning	· Computer Vision · Generative AI · Large Language Models · Gradient Descent Optimization · Retrieval-Augmented Generation · Reinforcement Learning · Point Cloud Processing · CUDA
Simulators	· CARLA · iGibson · (Py)Bullet · Gazebo · Webots
Mictrocontrollers	· UART/I2C/SPI · Systems on Chip · Real-Time Systems · Interrupt Triggers · Discrete Signal Processing