Nefelie Hemrich

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EDUCATION

Master of Engineering in Maritime Engineering | University of Southampton, UK *Sept 2020 - Jun 2024*
Grade: First Class Honours (average: 79%) + Best Performing Student prize 2023
Specialised in Robotics & Machine Learning (Maritime Robotics, Intelligent Mobile Robotics, Machine Learning).
Bachelor's Thesis: *"Constructing a Global Shipping Network Using AIS Data and Graph Theory to Enhance Maritime Situational Awareness"* (see link)

- Developed an unsupervised graph-extraction methodology using machine learning (KNN, DBSCAN) and graph theory to model maritime routes and analyse global traffic patterns, presented to the UK Government Department for Transport.
- Designed and implemented a data processing pipeline to clean AIS data and compress vessel trajectories.
- Analysed maritime traffic variability and congestion to provide insights into global shipping routes and supply chains.

Master's Group Design Project: *Perception System Design for an Autonomous Surface Vessel*

- Designed and simulated a perception system using stereo cameras and LiDAR in Gazebo with ROS2, enabling collision avoidance in marine environments.
- Developed object detection algorithms for vision and point cloud data under varying weather conditions and sea states.
- Integrated the perception system with obstacle avoidance sub-systems in a multidisciplinary team.

WORK EXPERIENCE

Research Assistant Intern | Marine & Maritime Institute, University of Southampton, UK *Jul 2023 - Aug 2023*
Generated a global marine corrosion map for shipping using AI/machine learning for integration into a digital twin for marine structures, supporting improved ship design and maintenance strategies to reduce costs. Implemented and trained an artificial neural network, employing k-fold cross validation to predict corrosion depth based on geospatial ocean datasets.

Research Assistant Intern | Marine & Maritime Institute, University of Southampton, UK *Jun 2022 - Sep 2022*
Produced a technical report and concept design for Shell Shipping & Maritime on a net-zero LCO2 bulk carrier with a carbon capture system to support UK's decarbonisation targets and developed a 3D model and render in Rhinoceros 3D.

PROGRAMMING SKILLS

Programming Languages: Python, C++, Java, MATLAB
Machine Learning: Keras, Pytorch, Scikit-learn, OpenCV, YOLO
Data Manipulation & Management: Pandas, Numpy, Scipy, SQL
Robotics: ROS2, Gazebo
Web Development: Typescript, HTML, CSS, FastAPI, Svelte
Other: OOP, Windows, Linux, Git, Docker

PROJECTS

Marine Autonomy Challenge 2023 | Society of Maritime Industries, UK
Led the University of Southampton team to 3rd place in a competition, developing software for an autonomous vessel to map and detect hydrocarbon pollution and ocean plastic. Implemented path planning, obstacle detection & avoidance algorithms (based on TTM), dynamic positioning, and network communication for integrating hardware (GPS, AIS, camera) via NMEA and serial protocols.

Guidance, Navigation & Control Software for an Autonomous Vessel | University of Southampton, UK
Implemented PID control, artificial potential fields for path planning, line of sight guidance for path following, and an Extended Kalman Filter for probabilistic localisation through python simulations. Worked with actuators (motors using differential thrust) & sensors, including an IMU for heading control and ArUco markers for localisation, to implement the software on the vessel.

SLAM and Perception System Development for an Intelligent Wheeled Robot | University of Southampton, UK
Implemented state-space control, trajectory planning, probabilistic localisation (particle filter), simultaneous localisation and mapping, interpreted live LiDAR sensor data using a Gaussian Process Classifier and Regressor. Integrated the perception and control systems into a graph-SLAM algorithm for autonomous navigation.

ACHIEVEMENTS

- *Prize for Best Performing Student in MEng Ship Science*, Worshipful Company of Shipwrights, UK, 2023
- *Prize for Highest Achievement in Ship Structural Design & Production* module, Babcock International, 2022
- *Publication in The Naval Architect:* "Southampton Student Team Designs a Net-Zero Liquid CO2 Gas Carrier for Future UK CCUS Projects," 2022, pp. 38-41
- *Honourable mention* in the 2023 *Worldwide Fully Electric Ferry Safety Association Design Competition*

LANGUAGES

English (native), German (fluent), Italian (fluent), Greek (fluent speaker, basic writing), Spanish (basic)