Sveučilište u Rijeci, Pomorski fakultet
University of Rijeka, Faculty of Maritime Studies

Financira Europska unija
NextGenerationEU

PROJECT ACRONYM AND TITLE: **Sea State Estimation from Wave-Induced Ship Response Using Advanced Deep Learning Methods (SEALEARN)**

FUNDING PROGRAMME: **Call for funding of Institutional research projects of the University of Rijeka financed from source 581 – Recovery and Resilience Mechanism (University of Rijeka, Institutional Research Projects)**

PERSON RESPONSIBLE: **Assist. Prof. Nikola Lopac, PhD**

Project total cost	29,958.64 EUR

SUMMARY AND OBJECTIVE: Accurate sea state estimation plays a key role in ensuring navigation safety, reducing fuel consumption, optimizing route planning, and advancing autonomous ship systems. Existing wave measurement systems, such as satellite and radar systems and wave buoys, face numerous limitations – from high costs and complex infrastructure to limited spatial and temporal resolution. As an increasingly recognized alternative, the concept of estimating sea state based on wave-induced ship response enables local and continuous measurements without additional specialized equipment, relying on vessel motion data already recorded during routine operations.

This project aims to develop a deep learning-based method for estimating sea state and wave parameters from ship response to wave excitation. Activities include collecting simulated data using numerical models and real-world data from operational navigation, their processing, and building a representative dataset for model development and evaluation. An advanced deep learning model will be developed and tested using state-of-the-art neural network architectures and advanced data preprocessing tecniques, with the aim of exploring the possibilities of sea state classification and the estimation of individual wave parameters. Special emphasis will be given to transfer learning across different vessel types and operational conditions, with the goal of increasing the robustness and generalization capabilities of the developed model.

Through an interdisciplinary approach, the project will result in a highly reliable and accurate computational model that can serve as a foundation for maritime industry applications and further development of scientific solutions in the field of maritime and intelligent systems. In the long term, the project is expected to contribute to improved navigation safety and more efficient vessel operation, particularly in the context of growing demands for digitalization and autonomy in maritime transport.

Start date	End date
1 October 2025	30 September 2029

PROJECT TEAM

No.	Member	Affiliation	Role
1.	Assist. Prof. Nikola Lopac, PhD	University of Rijeka, Faculty of Maritime Studies, Croatia	Head