FF4EuroHPC Success Story

HPC Vessel Maintenance Optimization by Natural Language Assistance

Organizations

SREC Solutions is an SME that offers an expert system platform for setting up Digital Assistants powered by AI and Natural Language Understanding to use in any connected textual and voice interface.

FIGAL Innova is a Spanish SME, a leader in marine surveying and maintenance engineering. FIGAL is specialized in assets such as maritime machinery, vessel hulls, containers, in more than 30 countries.

CESGA is a public foundation that provides HPC services for R&D, supporting SMEs to leverage their competitiveness through the usage of HPC.

End User

ISV

HPC Centre & Provider

Partner CESGA is part of the NCC Spain.

The Challenge

Maintenance costs in the maritime industry are steadily increasing and represent a huge inefficiency penalty due to breakdowns, unplanned repairs, and scarcity of spare parts. In order to improve the maintenance process and to better integrate it with their overall digitalisation approach, companies in the maritime industry are calling for the integration of virtual assistants into their maintenance processes. In response, FIGAL Innova and SREC Solutions developed a Vessel Predictive Maintenance System to monitor and assist a vessel's crew and operators with predictive maintenance of the ship machinery throughout its working life. This system includes capabilities based on voice command recognition. However, a virtual assistant must also work in highly noisy environments, increasing the complexity of such command recognition and producing a high number of misidentifications. Consequently, the challenge was to generate a Natural Language Processing system with increased reliability in noisy environments, which can be integrated into the virtual assistant with the ultimate goal of efficiently reducing vessel operating costs for predictive maintenance throughout the operational period in port and at sea.

Industry Sector
Transportation

Technology used:
HPC, AI, ML

The Solution

The Marine Words project developed a new Natural Language Processing system adapted to a set of the most commonly used commands in the sector, which works reliably in noisy environments. The solution is based on a noise filter that uses a Deep Learning (DL) technique to identify and train the correct model. Therefore, the processes to create the DL model and perform the training were executed on a remote HPC infrastructure, which permitted SREC to decrease the time-to-solution for each iteration to a feasible duration and also to test other processes to enable further exploitation such as periodic retraining to improve the model or adapt it to other environments. Once trained, the model was subsequently integrated with mobile devices for spoken command recognition. After HPC training, the Natural Language Understanding (NLU) algorithm can now correctly work with an accuracy superior to 95% in environments with a noise level of up to 80 dBm (90% of occurrences) using only software. This decreases customer investment like buying industrial headsets, which may cost up to €1,000 and entails safety concerns e.g. situational awareness.

The Impact

FIGAL can now offer a virtual assistant based on voice commands that have the potential to reduce up to 30% of maritime maintenance costs by (a) shortening their duration by up to 15%, (b) eliminating up to 30% of breakdowns due to insufficient parts and supplies during sea travels, and (c) reducing harmful maintenance gaps due to insufficient crew knowledge and awareness by up to 20%.

SREC now owns a proven technology for voice command technology that is functional in noisy environments and can be applied to many other sectors, enlarging the number of customers for its solutions.

For CESGA, the results of the Marine Words experiment are a demonstration of the benefits for SMEs of using HPC, which can be used to attract other companies and improve their support.

SREC and FIGAL are located in a small village far from the high-tech business centres of Europe. The results demonstrated that innovation can be driven by players in rural areas too, and thus that highly-qualified employment is possible in these areas.

Marine transportation carries over 90% of the global merchandise trade, totaling 11 billion tons of cargo per year. Hence, the improvements in maritime logistical chains have tangible repercussions in every economic sector. In the short term, they reduce the risk of shortages of essential goods and can contribute to controlling inflation; in the medium to longer term, they could result in acceleration of economic growth, employment, and lower trade costs.

Benefits

- New robust vessel maintenance assistant can reduce the maintenance costs to FIGAL's customers by 30%.
- SREC has a new methodology and technology to improve its products using DL and HPC.
- SREC expects to apply this technology to other sectors, with an increase of incomes of 20% yearly in the next 5 years.
- FIGAL and SREC expect to create 10 local jobs in the next 3 years.
- CESGA will use these results to leverage the usage of the HPC and Spanish NCC by Spanish SMEs, increasing the number of SMEs using its infrastructure and services by 10% annually.