

Doctoral Thesis:

On the Generalization of Machine Learning Algorithms for Mooring Line Tension Estimation of Floating Wind Turbines under Unknown Sea Conditions

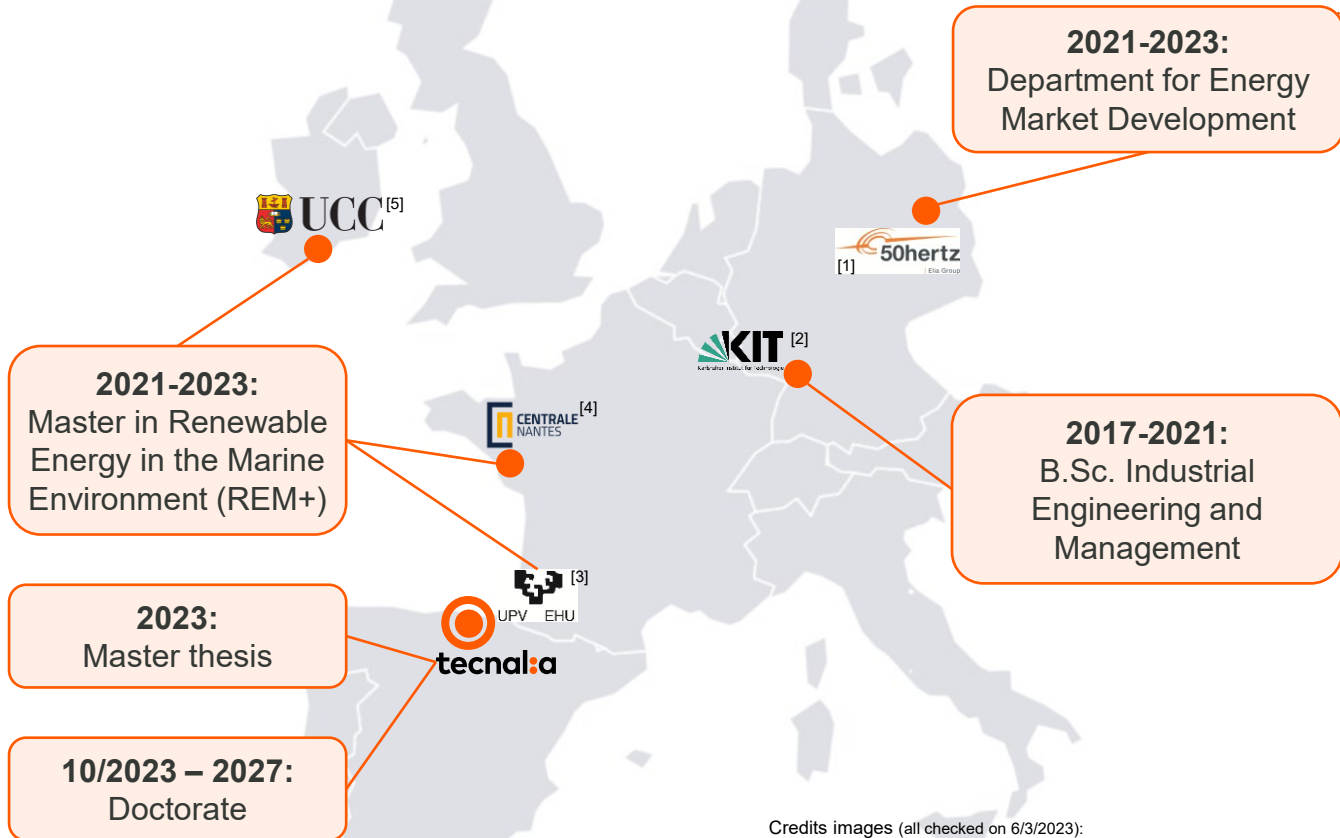
Student: Max Kämmerling

Co-directors: Javier Del Ser (Tecnalía & UPV/EHU), Vincenzo Nava (Politecnico di Torino)

About me



Max Kämmerling



Credits images (all checked on 6/3/2023):

[1] Source: 50Hertz

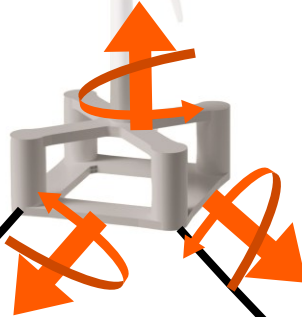
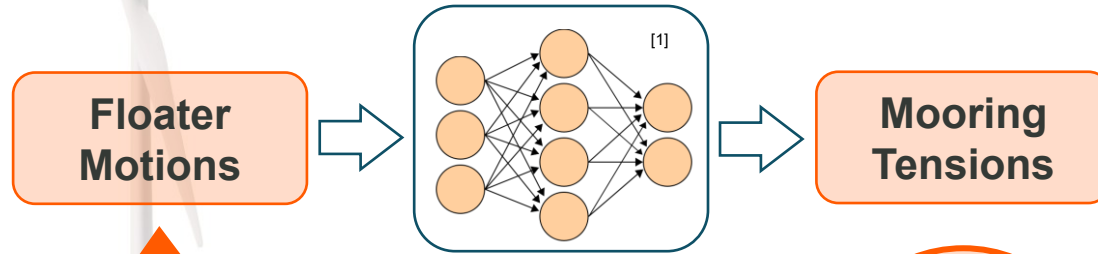
[2] KIT (2023): KIT Logo. Retrieved [online](#)

[3] University of the Basque Country UPV/EHU Logo. Retrieved [online](#)

[4] Centrale Nantes (2017): ECN Logo. Retrieved [online](#)

[5] UCC (2023): UCC Logo. Retrieved [online](#)

Motivation: Indirect measurement of Mooring Tension required for predictive maintenance of floating ORE devices



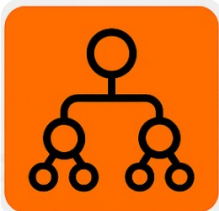
[1] Burgmer, Christoph (2010): Diagram of a multi-layer feedforward artificial neural network. Available [online](#), checked on 6/3/2023

Novel Extrapolative Tree Ensemble (ETE) model proposed



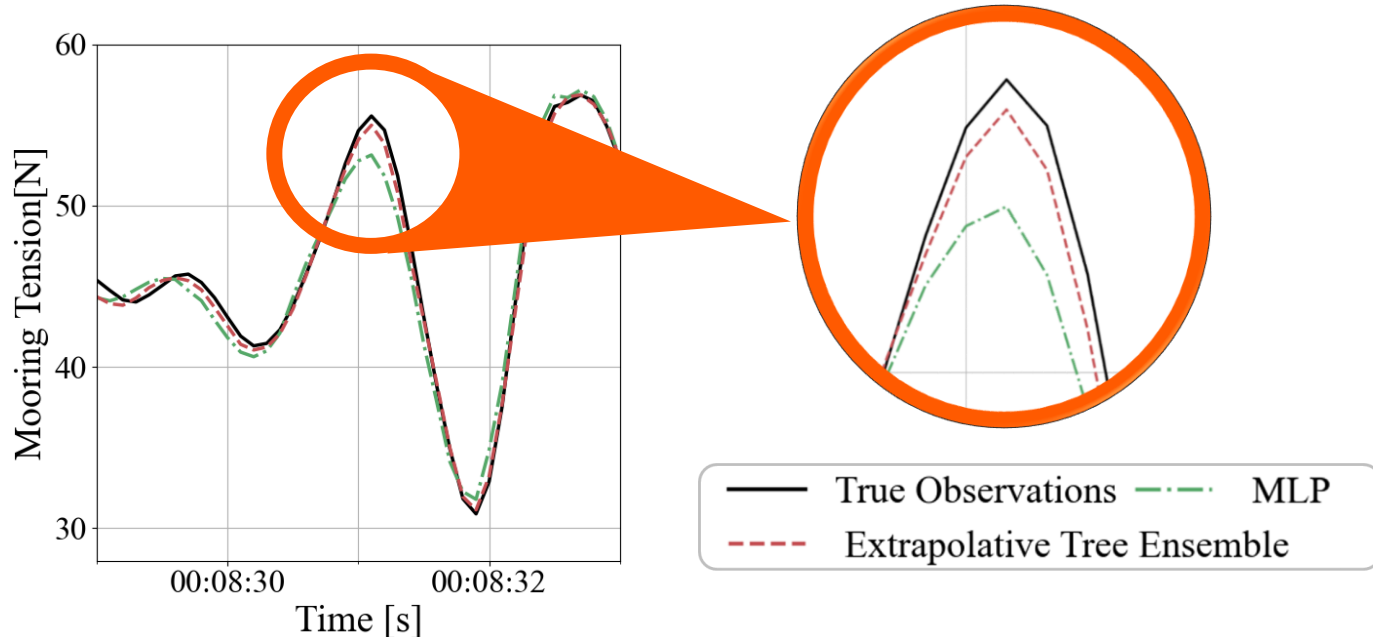
Built-in extrapolation mechanism for enhanced accuracy in unseen sea-state conditions

Built-in Model Degradation Indicator (MDI) to inform the user about large prediction errors



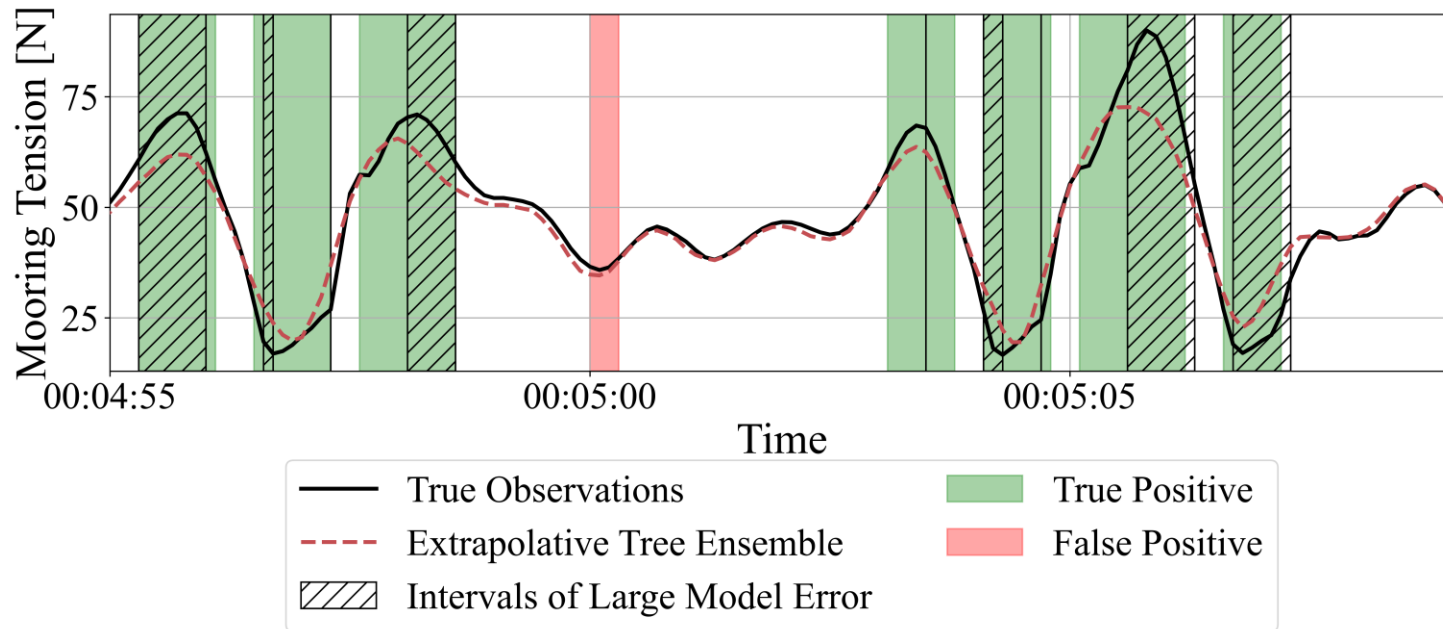
Tree-based structure enabling high interpretability compared to neural network models

ETE shows high generalization performance on high-energy sea states that are outside of the distribution of the training data



ETE's enhanced generalization is particularly evident during peak events

ETE's built-in Model Degradation Indicator reliably flags critical high-error segments



High true positive rate and low false alarm rate (TPR: 95.7%, FPR: 8.0%)



Thanks for your attention,
Eskerrik asko!



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● **Bilbao**
● **27/05/2026**



INORE'S 2026 EUROPEAN SYMPOSIUM



Side Event

INOREans meeting Basque ORE Companies

Networking - Poster Session - B2B-Meetings

Opportunity to meet over 40 PhD students and young professionals working and investigating in Offshore Renewables

Wednesday, 30th September 2026
Bilbao School of Engineering

Co-hosted by:



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Universidad
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