



Propuesta de Trabajo Fin de Máster

Año académico 2026-2027

MÁSTER EN CIENCIA DE DATOS PARA CIENCIAS EXPERIMENTALES

Proyecto Nº 3

Título: From Cells to Rivers: Machine-Learning Decoding of Environmental Water Quality Using Fluorescent Sensor Proteins

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Resumen:

This Master's thesis will repurpose genetically encoded fluorescent sensor proteins originally developed for cellular studies into a novel, mixed "cocktail" assay for rapid water-quality readouts. A curated panel of established sensors (e.g., for calcium, mercury, histamine/biogenic amines, pH, and other relevant targets) will be selected and combined based on spectral compatibility (distinct excitation/emission profiles, minimal bleed-through, stable brightness). The project will establish a robust measurement workflow to record the full fluorescence spectral response of the cocktail in contact with natural environmental water samples, producing reproducible spectral "fingerprints" that can be measured with standard fluorimeters and translated into an easy-to-interpret output.

In parallel, the same water samples will be independently characterized for chemical contaminants and biological-origin indicators using conventional analyses, generating ground-truth descriptors of water quality. Machine-learning models will then correlate the cocktail's spectral fingerprints with the sample characterization values to (i) learn predictive relationships between fluorescence patterns and contamination profiles, and (ii) identify the optimal combination of sensors (and channels) that maximizes sensitivity and interpretability in complex real-world matrices. The expected outcome is a first-of-its-kind framework for turning cell-derived fluorescent biosensors into a simple, multiplexed environmental screening tool, delivering a ranked set of best-performing sensor cocktails and a transferable ML-ready dataset for future expansion.

OPTATIVAS RECOMENDADAS

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