

# INFUSE 2025: International Conference on Frontiers of Unified Science and Exploration



Contribution ID: 103

Type: Oral

## DEEP BELIEF NETWORK FOR DETECTION OF MARINE POLLUTANTS AND SEA SURFACE FEATURES

Marine ecosystems are increasingly threatened by pollutants such as plastics, oil spills, and natural debris, which deteriorate water quality and endanger biodiversity. Traditional pollutant detection methods are often restricted to specific categories, making them inadequate for addressing the diverse and complex nature of marine pollution. Recent advances in satellite remote sensing and deep learning provide a scalable and automated solution for monitoring these threats at a global level.

In this study, we propose a deep learning-based framework for detecting marine pollutants and sea surface features using satellite imagery. The methodology begins with clustering through Self-Organizing Maps (SOMs), which not only group pollutants but also reduce dimensionality for efficient processing. Subsequently, image features are extracted through convolution, flattened, and passed into a Restricted Boltzmann Machine (RBM) for unsupervised learning. Multiple stacked RBMs are then used to construct a Deep Belief Network (DBN), enabling the system to learn hierarchical feature representations. The DBN is trained to classify pollutants into 15 distinct categories, achieving accurate differentiation between multiple pollutant types and natural sea surface patterns.

By integrating SOM-based clustering with deep generative models such as RBMs and DBNs, the framework demonstrates strong generalization across diverse oceanic conditions, including coastal, seasonal, and open-ocean environments. Ultimately, this work shows how combining satellite data with deep unsupervised and hybrid learning methods can enhance pollutant detection, leading toward real-time monitoring solutions for sustainable ocean management.

**Keywords:** Marine pollution, Satellite imagery, Self-Organizing Maps, Deep Belief Network, Sustainable ocean management

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**Track Classification:** Mathematical & Data Sciences