Object recognition on heterogeneous backgrounds using hybrid deep learning for spatial inverse problems

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This paper investigates hybrid deep learning-based approaches for object recognition tasks on spatial data with complex, heterogeneous backgrounds, contrasting with one-stage detectors. The study focuses on the semantic imaging of maritime vessels against noisy back-grounds, including sun glares on water, third-party artifacts, and clouds. The approach was evaluated on a pre-processed SPOT satellite dataset and achieved a recognition F2 accuracy of 0.8512. Potential applications for related computer vision tasks, such as object tracking, as well as spatial inverse tasks, such as risk management, are discussed.

Mental Fatigue Induced by Exposure to a WiFi Range Electromagnetic Noise Generator

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The study aims to determine human mental fatigue resulting from exposure to an electromagnetic noise generator operating in the frequency ranges of 2400-2500 MHz and 5150–5350 MHz (Scorpio Suppressor Wi-Fi - 15) with a power of 4 W. To measure and analyze the electroencephalograms of a male participants (31.4 \pm 3.7 years), the "Neuron-Spectrum-4" electroencephalograph from Neurosoft was used. Electroencephalograms were analyzed according to the International "10-20" system in two regimes: regime 1 (baseline) and regime 2 (after exposure to the electromagnetic noise generator). Linear and nonlinear indicators were used as quantitative parameters: spectral power density of delta, theta, alpha, beta, and gamma rhythms, Lempel-Ziv complexity, and sample entropy.

The results of the study showed that 4 parameters confirmed the presence of mental fatigue: Lempel-Ziv complexity, spectral power density of alpha, beta, and gamma rhythms; and 3 parameters contradicted mental fatigue: sample entropy, spectral power density of delta and theta rhythms. This allows us to conclude that human mental fatigue resulting from exposure to the electromagnetic noise generator operating in the frequency ranges of 2400–2500 MHz and 5150–5350 MHz is present.

Topological properties of the optical Tamm states in a one-dimensional chain of microresonators

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Among the important tasks of topological photonics, there are the use of electronic topological insulators as optical materials and the use of photonic topological insulators. These include obtaining topologically stable optical Tamm states and topological states on arrays of vertically emitting microlasers. In this paper, we investigate topological and boundary states in a one-dimensional Su-Schrieffer-Heeger (SSH) lattice of microresonators with a defect in the center. A zigzag lattice can be used as an example, with alternating longitudinal and transverse connections between vertical lasers acting as microresonators. Microresonators at the edges are strongly connected, but the periodic alternation of strong and weak bonds is disrupted by several strong bonds placed in the center for symmetry. We consider finite lattices with an odd number of microresonators for simplicity. The Hamiltonian of the system is a two-diagonal matrix H. The complex coefficients in the Hamiltonian represent the phase shift of the coupling constants. The H matrix is self-adjoint, so its eigenvalues are real. In this paper, we explore the defective and topological modes that arise in the lattices we study. A crucial aspect is the practical realization of a chain with complex couplings.