European Association of Remote Sensing Laboratories
3-rd Student Workshop on Ecology and Optics of Coastal Zones

NEURAL NETWORK SOLUTION OF AN INVERSE PROBLEM IN RAMAN SPECTROSCOPY OF MULTI-COMPONENT SOLUTIONS OF INORGANIC SALTS: TRAINING WITH NOISE AS A METHOD TO INCREASE NOISE RESILIENCE OF THE SOLUTION

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Introduction

Problem

The problem of determination of concentrations of substances dissolved in water is very important for:

- Oceanology
- Ecological monitoring
- Control of mineral, industrial and waste waters.

This problem is required to be solved in non-contact express mode with acceptable precision.

Introduction

Methods of determination of concentrations of substances dissolved in water

Chemical methods:

Advantages:

- Good accuracy

Disadvantages:

- Need for laboratory equipment and special reagents.
- Each test requires substantial time.

Introduction

Methods of determination of concentrations of substances dissolved in water

Raman spectroscopy as an alternative to chemical methods:

Advantages:

- Express
- Non-contact
- The shape of Raman spectrum of a solution is highly sensitive to changes in ionic composition and concentrations of its constituent ions.

Disadvantages:

- At the moment there is no adequate mathematical model capable of describing these changes with due precision.

Neural Networks

Advantages:

- The absence of the requirement of a priori information about the form of the sought-for dependence
- Ability to train by examples
- Universality of approximation
- Resistance to noise in the data
- Ability to work with incomplete and contradictory data
- High operating speed of a trained network

Disadvantages:

- High computational cost of training
- Need for selection of the optimal architecture
- High requirements to the amount of data
- The ability of falling into local minima
- Dependence on initialization of weights

Poster

From the poster presentation you may learn:

- How to determine the concentrations of dissolved substances with the help of Raman spectroscopy
- What difficulties are met on this way
- What are neural networks and what are they made of
- How neural networks are used for processing Raman spectroscopy data

Thank you
for your attention!