Zürcher Hochschule
für Angewandte Wissenschaften

School of
Engineering

Dear Editors,

we wish to submit the new manuscript entitled: “Dual oxygen and temperature luminescence learning sensor with parallel inference”, for consideration to be published in the journal Sensors. We confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

In this paper, we describe a new type of learning sensor with parallel inference which is based on multi-task learning neural networks and allows the parallel inference of multiple quantities using one single indicator and one single measuring channel.
The classical approach to luminescence sensing is to use an approximate mathematical model describing the functional dependence of the measured quantities and to apply non-linear fitting algorithms. With this sensor we show how to generate automatically and autonomously a very large dataset of measurements and how to use it for the training of the proposed neural-network-based signal processing. Furthermore, we demonstrate how the sensor exploits the cross-sensitivity of multiple parameters to extract them from a single set of optical measurements without any a priori mathematical model with unprecedented accuracy. To estimate the performance of the sensor, we introduce a completely new metric, which measures the maximal error in the predictions when using a neural network approach.
In general, the methods described in this paper are not limited to oxygen and temperature sensing but can be applied to the luminescence of multiple luminophores, whenever the underlying mathematical model is not known or is too complex to derive the desired quantities from a single measurement.

Sincerely,

Prof. Dr. Francesca Venturini
Institute of Applied Mathematics and Physics
Zurich University of Applied Sciences
Technikumstrasse 9, 8401 Winterthur, Switzerland