Master in Photonics – "PHOTONICS BCN"
Master ERASMUS+ "EuroPhotonics"

MASTER THESIS PROPOSAL
Dates: April 2021 - September 2021

Laboratory: Semiconductor laser lab, Dynamics Nonlinear Optics and Lasers (DONLL)
Institution: Universitat Politecnica de Catalunya
City, Country: Terrassa, Barcelona, Spain

Title of the master thesis: Recovery of experimental parameters from the analysis of observed optical signals, by using machine learning and signal processing tools

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Keywords: diode lasers; optical chaos; symbolic analysis; machine learning

Summary of the subject (maximum 1 page):
Diode lasers with optical feedback from an external mirror can emit a chaotic output, depending on the experimental physical parameters. The emitted chaotic signals have found several applications, including all-optical random number generation [1]. The complexity of the optical signal can be controlled by a periodic modulation of a physical parameter.
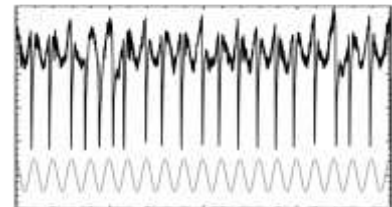
The goal of the TFM is to characterize the signal complexity as a function of the periodic modulation of the laser pump current (dc level, waveform, amplitude and frequency). The figure shows an example of the time trace of the input modulation (grey) and the output laser intensity (black).
The TFM can be done remotely, using signal processing tools and machine learning tools for the analysis of a database of time series of the laser intensity, which have been recorded for different amplitudes, frequencies and dc levels, and which can be downloaded from the lab website.
[1] M. Sciamanna and K. A. Shore, "*Physics and applications of laser diode chaos*", Nature Photonics 9, 151 (2015).

Additional information (if needed):
* Required skills: Solid computational skills are mandatory; a basic knowledge of machine learning is desirable.
* Miscellaneous: A scholarship is possible depending on the skills of the candidate.