Periodic Generalisation in Neural Networks

Periodic signals play an important role in daily lives. Although conventional sequential models have shown remarkable success in various fields, they still come short in modeling periodicity; they either collapse, diverge or ignore details.

It has been demonstrated experimentally that the standard activation functions, such as ReLU, tanh, sigmoid, along with their variants, all fail to learn to extrapolate simple periodic functions. This had been attributed to their lack of a “periodic” inductive bias, and as a fix, various activation functions built from trigonometric periodic functions have been proposed.

Our critical analysis of these newly proposed activation functions showed that while these functions indeed achieve the goal of learning periodic functions, they do so almost exclusively only when the frequency of the periodic functions is known a priori.

As a project we would therefore like to

1. continue the development of a benchmark already started at DISCO to better (and more meaningfully) challenge the existing models,

2. implement some of the most recent models attempting to tackle the problem of generalising periodic function trained only on a small range of values to the full range of possible inputs, and

3. develop our own model attacking the issues experienced by the contemporary models from an algorithmic perspective.

Candidate Profile. Varies from project to project. Bachelor’s students and Master’s pursuing their semester project will work on a smaller project, focusing mostly on items 1 and 2. Master’s students will work on an larger project, coding and advancing our work on all of the above.

Generally speaking, a good candidate is a motivated, competent programmer in the language of his/her choice, and is interested in deep neural networks. Prior practical experience in deep learning is not strictly required but would help, especially at the beginning.

Interested? Please contact us to learn more!

Contact

- Peter Belcak: belcak@ethz.ch, ETZ G61.3