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Interpolation between linearized Neural Networks

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Learning with function approximators became an important topic to connect data to predictors. When solving generic regression problems with ANNs, the behaviour of hyper parameter estimation has recently been analyzed in the context of NTK[0], i.e. in the framework of Linear Time Invariant system models. This unlocks new methodologies to systematic analyze and handle the losses arising at regression problems and hence improve the speed of convergence, providing guarantees. It brings a new view in machine learning supported by systems and control theory.

In this project, the original NTK [1] framework is expanded to a linear, scheduled kernel approach. The main idea is to introduce NTKs to cover the domain of attraction or validity of the originally nonlinear differential condition obtained at gradient decent method. A grid of kernels (LTI models) is therefore suggested to be created. In order to connect the local kernels (to mimic the original gradient decent method), interpolation method among gridpoints can be done.

In this way, linear but scheduled model and control paradigms become unavoidable to assist in generalized ANN regression problems. Numerical complexity and control/estimation problems for the set of scheduled NTKs carry new, and revelational view in the booming field of machine learning.

The project is being carried out in a joint project between Centiro and Chalmers. Centiro is a logistics company located in Borås and is in the middle of an industrial wide paradigm shift to focus on Data Science. Centiro is funding multiple industrial PhD positions and this project will be in collaboration between Chalmers and Centiro.

Do you want to be part of this development/research? Email us!

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[1] Jacot, Arthur; Gabriel, Franck; Hongler, Clement (2018), Bengio, S.; Wallach, H.; Larochelle, H.; Grauman, K. (eds.), *Neural Tangent Kernel: Convergence and Generalization in Neural Networks* Advances in Neural Information Processing Systems 31,pp. 8571–8580, arXiv:1806.07572