We aim to compare LSTMs, GRUs and Deep Operator Networks (DeepONet) by learning multi-scale bubble growth dynamics amidst pressure fluctuations. This problem is governed by Rayleigh-Plesset (R-P) Equation and can be derived from the Navier-Stokes equation. This is a challenging problem as the equation governing the multi-scale system is a stiff ODE. Unlike LSTMs and GRUs that are function (mapping from a real-space to real-space) approximators, DeepONet approximates the operator (mapping from a function-space to function-space) and are therefore expected to generalize better. On providing the temporal pressure fluctuations as the input, the deep neural network model should estimate the corresponding variations in the bubble radius with respect to time.

As the data is not available, we will generate it using Finite Difference Method. The models will be implemented from scratch. We will also carry out a detailed analysis and systematic comparative study on the three models. Specifically, we intend to inspect how a neural network model learns the underlying function in the frequency domain.

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