REPORT ON THE PAPER "NONLOCALITY AND NONLINEARITY IMPLIES UNIVERSALITY IN OPERATOR LEARNING"

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ABSTRACT. Neural operator architecture approximate operators between infinite dimensional Banach spaces of function. The paper discuss the basic questions about the requirements for universal approximation of neural operator and provide conditions under which neural operators are universal approximators. Author argued that the general approximation of operators between spaces of functions must be both *nonlocal* and *nonlinear*.

A popular variant of neural operators is the Fourier neural operator (FNO). Proving universal approximation theorem for FNOs is based on using unbounded number of Fourier modes, this work challenges this point of view and provide a novel minimal architecture called "averaging neural operator" (ANO) and its analysis showed that ANO is also a universal approximator. Only spatial average is taken as nonlocal ingredient which corresponds to retaning only a single Fourier mode in the case of FNO contrasts to unbounded number of modes.

1. Introduction

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