1154-41-167 **Simon Foucart***, foucart@tamu.edu. *Nonlinear Approximation and (Deep) ReLU Networks.*

This talk concerns the approximation power (sometimes called the expressive power) of deep neural networks. The most common results found in the literature prove that neural networks approximate functions with classical smoothness to the same accuracy as classical methods, e.g. approximation by polynomials or piecewise polynomials on prescribed partitions. However, approximation by neural networks depending on n parameters is a form of nonlinear approximation and as such should exhibit the increased efficiency of nonlinear approximation methods. We show that this is indeed the case. Furthermore, the performance of neural networks in targeted applications such as machine learning indicate that they actually possess even greater approximation power than traditional methods of nonlinear approximation, such as free knot splines or n-term approximation from a dictionary. We again show that this is indeed the case. To do so, we exhibit large classes of functions which can be efficiently captured by neural networks where classical nonlinear methods fall short of the task. Our work purposefully limits itself to studying the approximation of univariate functions by ReLU networks.

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