1150-08-671 **Jesus A De Loera** (deloera@math.ucdavis.edu), Department of Mathematics, University of California, Davis, One Shields Avenue, Davis, CA 95616, **Robert Krone** (rkrone@math.ucdavis.edu), Department of Mathematics, University of California, Davis, One Shields Avenue, Davis, CA 95616, and **Sara Jamshidi Zelenberg*** (szelenberg@iit.edu), Department of Applied Mathematics, Illinois Institute of Technology, 10 W 32nd St, Chicago, IL 60616. *Polynomial neural networks for learning varieties.* Preliminary report.

A feedforward artificial neural network is a (low bias, high variance) method of supervised learning, where the class of potential functions being fit to the data is described by a directed, k-partite graph and an activation function (like x_+, called $ReLU$, or $\frac{1}{1+e^{-x}}$, called *sigmoid*). Practitioners in machine learning often make adjustments to the topology of this graph in order to improve the learning task; however, there is very little intuition behind these adjustments. In this work, we describe the meaning of these topological adjustments when the activation function is chosen to be polynomial–something not typically done as such a system cannot well-approximate functions in $C^1(K)$ for some compact set $K \subset \mathbb{R}^{\ltimes}$ when allowing for arbitrarily large independent sets in the k-partite graph, called *layers*. Here, we demonstrate not only the meaning of the underlying topologies, but the ability of such a network to learn various algebraic varieties and gauge the potential for other applications. (Received July 17, 2019)