In this thesis we aim to build algebraic models in computer using machine learning methods and in particular neural networks. We start with a set of axioms that describe functions, constants and relations and use them to train neural networks approximating them. Every element is represented as a real vector, so that neural networks can operate on them. We also explore and compare different representations. The main focus in this thesis are groups. We train neural representations for cyclic (the simplest) and symmetric (the most complex) groups. Another part of this thesis are experiments with extending such trained models by introducing new "algebraic" elements, not unlike the classic extension of rational numbers $\mathbb{Q}[\sqrt{2}]$.