**Generating Crystal Structures with Artificial Neural Networks**

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**Objective.** To create a system capable of taking in chemical formulae and producing crystal structures that are likely to exist in reality. This is done to assist in vetting materials for favorable properties and as a step towards inverse design from properties to materials. **Methods.** A Generative Adversarial Network was utilized to map from chemical formulae to atomic positions within crystal structures. These systems made up of neural networks, which are analogous in some ways to human brains, are trained over time to generate fake samples and to differentiate between these fake samples and real data. The architectures of our neural networks borrow heavily from multiple fields, ranging from Computer Vision and Natural language Processing to Graph Theory. **Results.** This method produces visually realistic generated crystal structures. When validated using held-out real crystals, it becomes apparent that although the generated structures are plausible, they do not match the mapping between real formulae and structures exactly as seen in our data. It should be noted, however, that multiple valid crystal structures are possible for one chemical formula. **Conclusions.** Our model produces surprisingly visually realistic structures; however, more work is needed to validate and improve its performance. This work may include the quantification of differences between structures and the possible inclusion of these differences into the model’s optimization, as well as experimental validation of crystal structures deemed most promising by the model itself..