



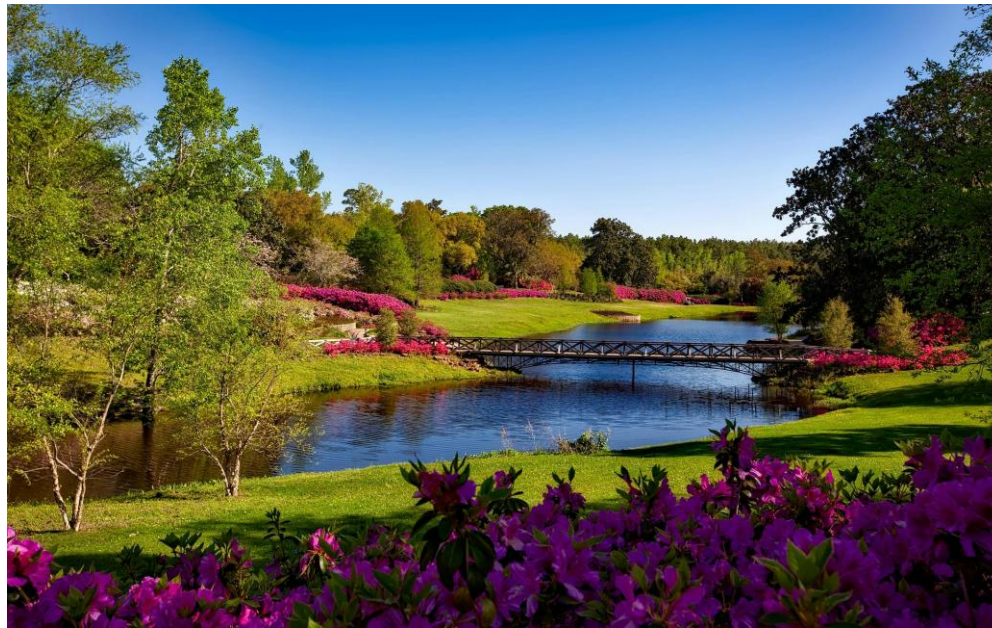
Most modern deep learning models are based on multi-layered [neural networks](#) such as [convolutional neural networks](#) and [transformers](#), although they can also include [propositional formulas](#) or latent variables organized layer-wise in deep [generative models](#) such as the nodes in [deep belief networks](#) and deep [Boltzmann machines](#).^[7]



Some common deep learning network architectures include [fully connected networks](#), [deep belief networks](#), [recurrent neural networks](#), [convolutional neural networks](#), [generative adversarial networks](#), [transformers](#), and [neural radiance fields](#). These architectures have been applied to fields including [computer vision](#), [speech recognition](#), [natural language processing](#), [machine translation](#), [bioinformatics](#), [drug design](#), [medical image analysis](#), [climate science](#), material inspection and [board game](#) programs, where they have produced results comparable to and in some cases surpassing human expert performance



Importantly, a deep learning process can learn which features to optimally place at which level *on its own*. Prior to deep learning, machine learning techniques often involved hand-crafted [feature engineering](#) to transform the data into a more suitable representation for a classification algorithm to operate on. In the deep learning approach, features are not hand-crafted and the model [discovers](#) useful feature representations from the data automatically. This does not eliminate the need for hand-tuning; for example, varying numbers of layers and layer sizes can provide different degrees of abstraction.



Deep learning is a subset of [machine learning](#) that focuses on utilizing [neural networks](#) to perform tasks such as [classification](#), [regression](#), and [representation learning](#). The field takes inspiration from [biological neuroscience](#) and is centered around stacking [artificial neurons](#) into layers and "training" them to process data. The adjective "deep" refers to the use of multiple layers (ranging from three to several hundred or thousands) in the network. Methods used can be either [supervised](#), [semi-supervised](#) or [unsupervised](#).^[2]