

# Self-Organizing Maps (SOMs)

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Self-Organizing Maps (SOMs) are a type of unsupervised learning neural network that is used for dimensionality reduction and data visualization. The algorithm is based on a competitive learning process in which neurons within the network compete with each other to represent different regions of the input data.

The SOM algorithm works by first initializing a two-dimensional grid of neurons, each of which represents a region of the input data. During the training process, each input sample is presented to the network, and the neuron that is closest to the input is selected as the "winning" neuron. This winning neuron and its neighboring neurons are then updated to better represent the input data. This process continues until the neurons have converged to represent the input data in a way that preserves its topological structure.

One practical example of using SOMs is in the analysis of customer purchasing patterns. In this example, the input data might consist of information about each customer's past purchases, such as the type of product purchased, the time of purchase, and the amount spent. By training a SOM on this data, we can visualize the relationships between different types of products and identify groups of customers with similar purchasing patterns.

SOMs have many applications beyond customer purchasing patterns, including image and speech recognition, document clustering, and anomaly detection.