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Birk Schmithüsen
contact@birkschmithuesen.com

KollektivArtesMobiles, Leipzig, Germany

Speculative Artificial Intelligence / exp. #1 (audiovisual association)

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Abstract:

In the aesthetic experiment the question of the nature of artificial intelligence in neural networks is investigated. They are credited with intelligent behavior because they can generalize learned rules and apply them to unknown data. The artist Birk Schmithüsen describes the reaction to unknown data as predictable unpredictability. In the experiment, the training process of an artificial neural network as well as the predictable unpredictability are audiovisually translated and intuitively experienced. Sounds are used as input data associated with images as output data. A spherical object makes the sound-image associations visible.
The object consists of a seemingly chaotic cluster of thirteen thousand LEDs in which readable patterns of light appear. Each LED is connected to an output neuron of the neural network and represent its state by its brightness. The LEDs are mapped in three-dimensional space. Training data is generated from classifications of sounds to three-dimensional shapes, and the state of the neural network is represented as a readable pattern of light.

1. INTRODUCTION

In the aesthetic experiment *Speculative Artificial Intelligence*, the predictable unpredictability of an artificial neural network is explored and its behavior is made tangible through audiovisual translation. The work uses machine learning strategies as a tool and object of investigation. The behavior of the network is represented sensualistically by a sequence of different configurations of the training process. A set of classifications of sounds to visual motives is given. With this training data, the neural network learns to produce readable visual forms. The potential as a tool for the production of audiovisual works is reflected in the associations of the trained network to unknown sounds. The training process sets the framework for the associations of the network. Similar to the score or the algorithm in performance and generative art, the selection of training data and the design of the training process decide on the resulting aesthetics of the artwork.

2. AUDIOVISUAL NEURAL NETWORK

Neural networks (NNs) consist of a finite number of individual linked algorithms (neurons), but their overall behavior shows significant differences to traditional algorithmic programming. While algorithmic programs produce causal relationships that are explicitly programmed by formal expressions, the behavior of neural networks is characterized by correlative relationships based on implicitly learned rules. This means that no basic principles are defined by explicit, formal descriptions compared to generative aesthetics. Neural networks can learn an aesthetic principle as a whole by a finite number of examples without formulated rules. The aesthetic principle is modeled as a complex web of correlative relationships rather than being described by algorithms.

2.1. Training

The training is the crucial moment in the creation of the system. It determines the type of connection between sound and image and the aesthetics of the visual output. This is done by a set of classified data, consisting of pre-produced sound-image assignments. In several cycles, the network receives sound material as input data. They get processed to image data, which are then compared with the corresponding

reference images of the training data set. The resulting deviation is determined and the neurons of the network adjusted to get closer to the expected result. The more training cycles are passed through, the more accurately the network reproduces the given classifications. The more classifications are given, the more reference points the network involves for the visual association of unknown sounds. Control over the visual outcome and its complexity increases with the number of training data and training cycles.

In the aesthetic experiment, the classified data consists of various sinusoids, as well as percussive sounds and noise associated with white planes at different positions within the volumetric object. The choice of sounds and visual forms is based on the comprehensibility and the possibility of differentiating the various classification.

2.2. Association

An audiovisual NN reacts to unknown sounds with associations in the form of transitions and mixed relationships between learned visual forms. The audiovisual training material may therefore be fragmentary and does not have to be a complete composition. Individual classifications can be made strong, such as linking silence with darkness and other connections that are supposed to reproduce an exact association. Other sounds may be left untrained to allow new visual forms to be produced by the NN. In this capacity lies the potential of machine learning for artistic production — in the controllably unexpected result. In other words, speculative artificial intelligence can be used to purposefully generate unpredictable images. The effect that classical AI research seeks to minimize, namely that an NN makes a "wrong" decision and produces a "mistake," can the artist rethink as a creative potential. The unexpected output comes about when decision-making takes place in untrained areas of the NN. These areas develop their behavior through surrounding trained points. Training therefore makes it possible to set the framework for the neural networks behavior. The compositional style with the use of speculative artificial intelligence has an analogy to John Cage's use of chance. Cage controlled chance as a means of composition through a set framework — the *I Ching*. With the training process the unpredictable predictability of speculative artificial intelligence can be controlled.

3. INSTALLATION OBJECT

The associations of the neural network become visible in a spherical object. The object has an inherent analogy to the structure of the network. It consist of a seemingly chaotic cluster of thirteen thousand LEDs, but can display readable volumetric shapes and structures because of their localization in the three-dimensional graphical space. The neural network is an accumulation of meaningless decision units in their untrained state. Through training the network gets enabled to make complex decisions. The training of the network as well as the spatial mapping of the LEDs represent a process of order of many small entities to one large unit.

Fig. 1.