A Method for Producing Animation as a Series of Backward-Projected Patterns in a Self-Organizing Map

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Abstract

A self-organizing map (SOM) can be seen as an analytical tool to discover some underlying rules in the given data set. Based on such distinctive nature called topology-preserving projection, a new method for generating intermediate patterns was proposed. Then, following to this method, producing animation as a series of backward-projected patterns just like a flip book is tried in this article.

Keywords : neural network model, self-organizing map (SOM), animation, morphing, dissolve

1. Introduction

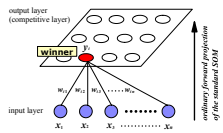
Recent development on the computer technology is remarkable, and it helps us to make various kinds of patterns quite easily. Taking into account of producing animation, for example, morphing is a series of interpolated patterns. Each of them is generated one by one from the given two patterns corresponding to the start and finish, respectively. On the contrary, another method based on neural network technology was proposed a fewyears ago. Then, following to this method, we try to produce some animation with simple patterns, e.g. emoticons, in this article.

2. A self-organizing map (SOM)

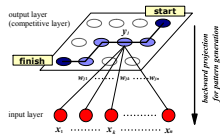
2.1 Overview of standard SOM

It is well-known that a self-organizing map (SOM) [1] is one of the famous neural network models consisting of two layers. As shown in Figure 1(a), one is an input layer whose neurons depicted by circles are aligned one dimension, and the other is an output layer whose neurons are aligned two dimensions. Also, all neurons are connected adaptively with each other. It was proposed as a model for biological visual information processing originally, but it has been used a convenient tool for signal conversion in various kinds of research fields. This is why the SOM can assign the similar patterns side by side on the output layerautomatically, which is known as topology-preserving projection, through training. Therefore, the output layer develops a sort of map divided into several regions corresponding to different categories. Once a new pattern is applied to the SOM, we can identify its category based on the location where the winner will appear.

* The latter one is sometimes called "*a competitive layer*".



(a) conventional forward projection

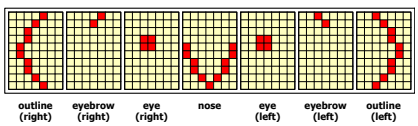


(b) proposed backward projection

Figure 1. A self-organizing map (SOM).

(' ・∨・` )　( ' ・∧・`)　(' ・ω・`)
(` ・ω・ ' )　( ' Д `)　(' ∨ `)
(^ ω ^)

(a) seven kinds of *symmetrical* emoticons



(b) actual representation of applied pattern
--- 10 dots x 7 dots x 7 characters ---

Figure 2. Training patterns adopted in this study.

2.2 Basic idea for generating new patterns, and producing animation

Based on the distinctive nature as mentioned above, a new method for generating intermediate patterns was proposed a few years ago [2]. Not

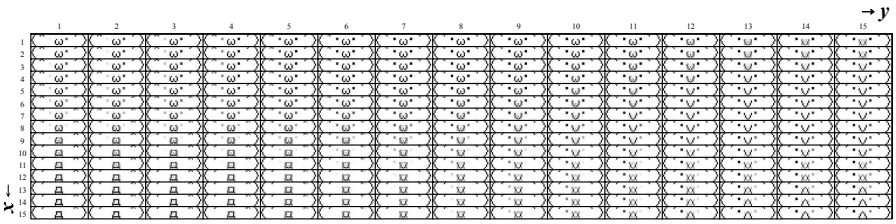


Figure 3. Acquired feature map on the output layer developed through training.

shown here for brevity, each neuron in the output layer is developed to be in charge of a particular pattern, so backward projection is just extracting a pattern from the corresponding neuron in the output layer. Furthermore, if we provide any pathway on the output layer as shown in Figure 1(b), sequential backward projection along with this pathway makes emerge corresponding patterns one by one serially on the input layer. It is animation just like a flip book. It is important to address here that it might contain any patterns beyond our expectations because of adaptability the SOM possesses.

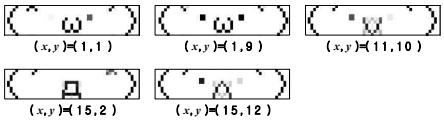


Figure 4. Some examples of generated asymmetrical emoticons.

3. Computer simulations

3.1 Methods

In this article, emoticons are adopted for training. They are quite simple, but sufficient to express our emotion effectively. As shown in Figure 2, all patterns are symmetry, and consisting of seven letters. Each letter in the emoticon is designed by 10 dots in height and 7 dots in width. Then, the number of neuronsin the input layer is fixed at 490 (=10x7x7), while that in the output layer is fixed at 225 (=15x15).
During the training period, the Euclidian distance measure is common to determine the winner, but a fragmentized distance measure is introduced in this study. This is why each emoticon consists of several partial components, and we never intend to destroy them.

3.2 Results for generating new patterns

Figure 3 shows an example of acquired feature maps developed through training. Each pattern in the 15x15 grid is the one generated by the corresponding neuron in the output layer. At first glance, it is confirmed that similar patterns are aligned smoothly from the left to the right, and also from the top to the bottom. Even though only symmetrical patterns are used for training, some asymmetrical ones as shown in Figure 4 are observed in the generated patterns.

3.3 Results for producing animation

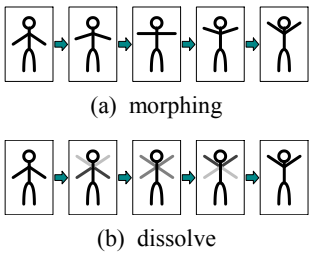


Figure 5. Two kinds of changes between arbitrary two patterns.

As a next step, some animation is produced based on a series of backward-projected patterns. Although their appearance isnot so attractive, but it is surely confirmed that we can produce it just like a flip book. In order to make more attractive, we had better take more care of selecting the patterns used for training such as stick figures.
By the way, there are two kinds of changes between arbitrary two patterns. As shown in Figure 5, one is morphing, and the other is dissolve. What we want to generate is the former one, but what we can acquired actually is the latter one. Then, in order to produce more natural transitions, we should investigate how to accomplish morphing which we have intended in advance.

4. Conclusions

In this article, we try to produce some animation following the SOM-based method proposed a few years ago. As a result of computer simulations, we surely made it successfully. But it is true that there are some problems from the viewpoints of appearance. Then, further investigations will be required to brush up this technique.

4.1 Acknowledgements

This work was partially supported by a Grant-in-Aid for Scientific Research (C) No.20500208 from the Japan Society for the Promotion of Science.

4.2 References

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