

Artwork Classification

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Predicting

Our goal of this project is to build a classifier that can identify different painting styles of artworks. Using machine learning to realize an accurate classifier can help us learn about the internal features of a particular painting style because it is even challenging for humans to identify the style ourselves. We implement different classifiers (SVM, RF & CNN) to compare their performance for this task and get acquainted with these algorithms. We intend to achieve a 90% accuracy with one of the algorithms. The final accuracy for CNN is 74%

Data

The dataset we used is called *Collections of paintings from 50 artists* which is retrieved from Kaggle provided by Lcaro. The original dataset contains more than 8000 paintings with different sizes, so we resized them into squares with 128*128 pixels. After excluding those artists with more than one style, the final dataset has 2400 images and 8 styles when 2000 of them are chosen as the train set and 400 of them are chosen as the test set.



Feature/model

Support Vector Machine

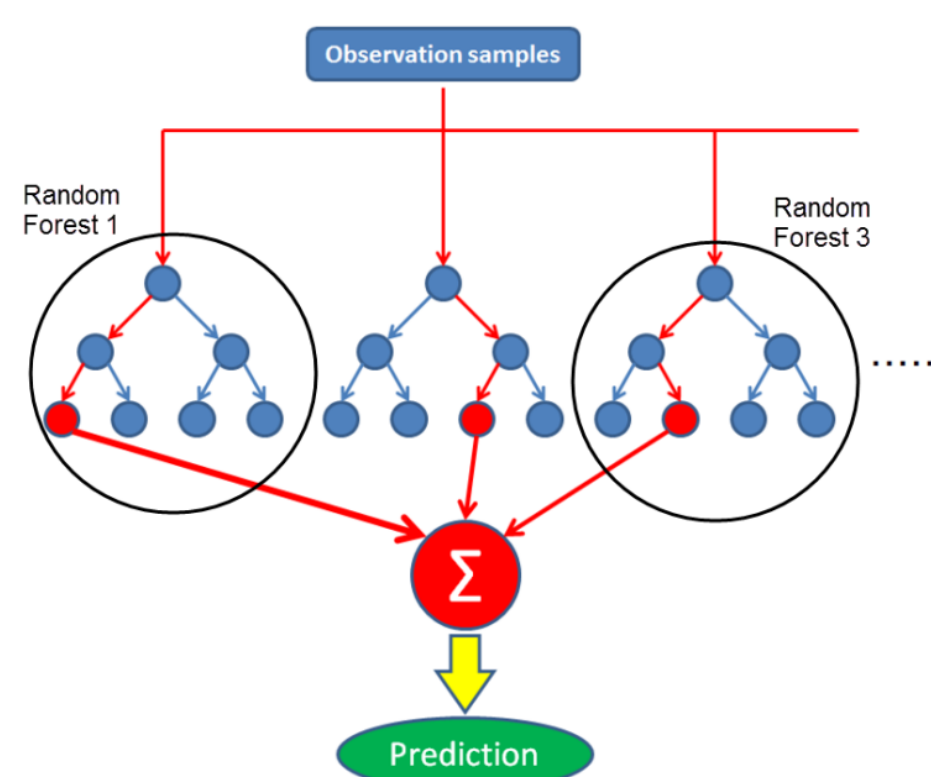
The SVM we used was a radial basis function (RBF), nonlinear kernel, multiclass SVM, as we had 8 painting styles and no guarantee of them being linearly separable in the feature space.

$$K(\mathbf{x}, \mathbf{x}') = \exp\left(-\frac{\|\mathbf{x} - \mathbf{x}'\|^2}{2\sigma^2}\right)$$

$$\min_{\mathbf{a}} \mathbf{a}^T \mathbf{K} \mathbf{a} - \mathbf{1}^T \mathbf{a} \quad \text{subject to} \quad \mathbf{t}^T \mathbf{a} = 0, \quad 0 < \mathbf{a} < C$$

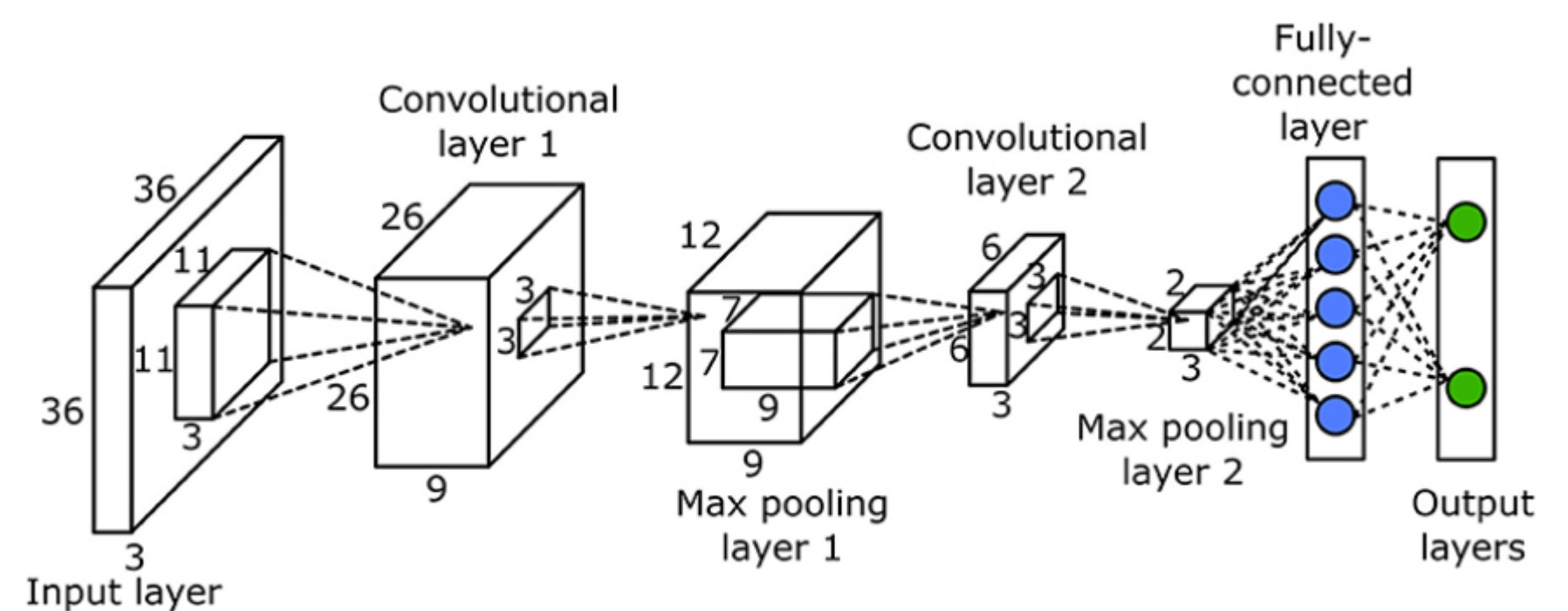
Random Forest

The RF algorithm depends on devising multiple division trees during training and outputs the mod of the classes of individual trees.



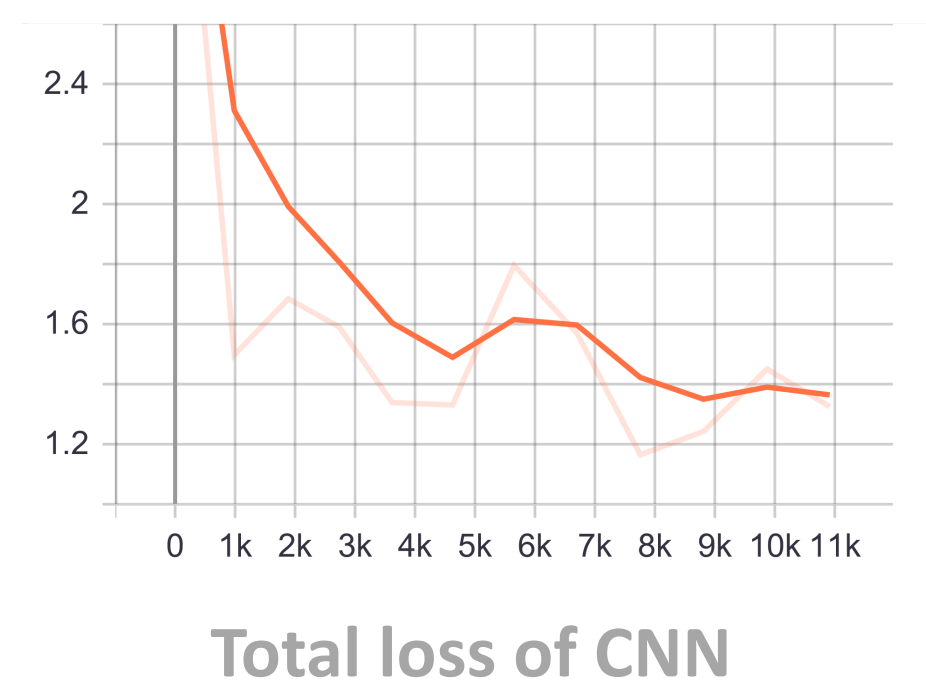
Convolutional Neural Network

The convolutional layer of CNN algorithm can extract the feature of training data automatically. Pooling layer is for feature selection and fully connected layer for classification



Result

Models	Accuracy
SVM	35%
Random Forest	39.75%
CNN	74%



The classification accuracy of SVM and RF is not acceptable, while CNN can achieve a relatively satisfying result.

Discussion

The accuracy of SVM and Random Forest are below 40%. This is because we cannot find a proper way to extract the feature of each painting style manually. Using CNN, however, can extract the features automatically by passing the data through convolutional layers. The result of CNN shows its accuracy is indeed much better.

Future

The accuracy of SVM is not satisfying because we cannot. In the future, we will provide the SVM classifier with the feature extracted by CNN to improve the accuracy. We will also try to convert a picture from one painting style to another one.

Reference

- [1] Best Artworks of All Time: collection of paintings of 50 most influential artist. <https://www.kaggle.com/ikarus777/best-artworks-of-all-time>
- [2] L. A. Gatys, A. S. Ecker, and M. Bethge, "Image Style Transfer Using Convolutional Neural Networks," 2016
- [3] M.-Y. Liu, T. Breuel, and J. Kautz, "Unsupervised Image-to-Image Translation Networks," Advances in Neural Information Processing Systems (NIPS), 2017.