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Automatic Classification of Home Appliances Image Based on Markov Random Field

Hao Yuan, Feng Jin, Yi Zeng [a]

School of Computer Science and Technology, Nanjing Normal University, Nanjing, China

[a]05277@njnu.edu.cn

Abstract: Compared with other kinds of information sources, images have the characteristics of large information capacity and high complexity, which makes the image recognition research difficult. In order to solve the problems of timeliness and redundancy of data, we use Markov random field algorithm to extract image features of a large number of electrical image sets, and then completes an online image recognition system.

Keywords: Deep Learning, Image Recognition, Markov Random Field.

1. Introduction

In today's society, the development of science and technology makes the Internet have a great impact on everyone's daily life, and online shopping has become the first choice of people's shopping. More and more big data are constantly changing with the needs of consumers. The characteristics of e-commerce data are various categories and fast update speed. Through the identification of the main electrical appliances in the image, it can be classified, so as to solve the problems in the images uploaded by the merchants, and effectively distinguish the types and brands of electrical appliances. In this paper, we promote a different approach, the current popular e-commerce enterprise application needs and image recognition technology based on deep learning are fused. Markov random field algorithm is used to identify the image. At the same time, the system can realize the normalization of corresponding commodities and improve the accuracy of sales and inventory statistics. The integration of e-commerce and image recognition technology based on deep learning makes the identification and push of enterprise products more intuitive and convenient, which will greatly improve the user's sensory experience. The improvement of the accuracy of sales and inventory statistics will effectively promote the economic benefits of enterprises. The

research method of this paper provides an effective research direction for social industry to solve this kind of problem.

The Markov random field (MRF) plays an important role in the probability graph model. The probability graph model was originally introduced to solve the problem of parameter explosion caused by not considering the relationship between parameters. As early as 1988, Judea pearl [1,2] first mentioned the concept of probability graph. In 1990, based on the study of statistics, J. Whittaker proposed the probability graph model [3]. Since then, researchers have found that probability graph can well describe the relationship between random variables, and then use it to solve a variety of practical problems. Among them, because of the similarity between its structure and image structure, the use of MRF is also very common in the direction of image processing. Because the joint probability density calculation of MRF is more complex, the calculation of joint probability density of Markov random field [4] can make use of the equivalence between MRF and Gibbs. In 1906, Markov first proposed MRF sequence. In 1942, ITO established stochastic analysis theory to study the special process of Markov diffusion process, which opened up a new direction for the study of Markov chain [5]. Then, the large-scale research and application of Markov random fields are initiated. At present, Markov process, Markov random field, infinite particle Markov process, measure value branching process, Markov process on manifold are all urgent parts to be studied [5].

In this paper, we promote the Markov Random Field based image recognition system for e-commerce appliances proposed, considering the complex background of some pictures in the actual situation, and identify images with simple and complex background.

2. MRF Random filed Model

Random field model

If there is a joint probability distribution with a random variable satisfying the above conditions, if it is represented by an undirected graph, the edges in the graph are used to represent the dependence between points (random variables), which is called MRF, i.e. the conditional random field (CRF) model.

We add the values of each position in the CRF formula which defines the same feature, and change the local eigenfunction into the global eigenfunction, so that CRF can be expressed as the inner product of the weight vector and the eigenvector. There are Kt transfer features, K2 state features, and notes：$K = K_1 + K_2$

$$P(y|x) = \frac{1}{Z(x)} exp \sum_{k=1}^{K} w_k f_k(y, x) \qquad P_w(y|x) = \frac{exp(w \cdot F(y,x))}{Z_w(x)}$$

Matrix model of CRF

Assuming that it is expressed by inner product, the order matrix (the number of

marked values) is defined for each position marked with the start and end states.

$$E_{P(X,Y)}[f_k] = \sum_{x,y} P(x,y) \sum_{i=1}^{n+1} f_k(y_{i-1}, y_i, x, i)$$

$$= \sum_{X} \tilde{P}(X) \sum_{i=1}^{n+1} \sum_{y_{i-1} y_i} f_k(y_{i-1}, y_i, X, i) \frac{\partial_{i-1}^{T}(y_{i-1} | x) M_i(y_{i-1}, y_i | x) \beta_i(y_i | x)}{Z(x)}$$

MRF learning model

$$E_{\tilde{P}}[s_l] = \sum_{x,y} \tilde{P}(x) P(y|x) \sum_{i=1}^{n} s_l(y_i, x, i) \exp(\delta_{k_i+1} T(x))$$

$$= \sum_{x} \tilde{P}(x) \sum_{y} P(y|x) \sum_{i=1}^{n} s_l(y_i, x, i) \exp(\delta_{k_i+1} T(x))$$

$$\delta_i(l) = \max_{1 \le j \le m} \{\delta_{l-1}(j) + w \cdot F_i(y_{i-1} = j, y_i = l, x)\}, l = 1,2,\ldots,m$$

$$\Psi_i(l) = \max_{1 \le j \le m} \{\delta_{l-1}(j) + w \cdot F_i(y_{i-1} = j, y_i = l, x)\}, l = 1,2,\ldots,m$$

3. Image classification and recognition

For an object, its features are mainly divided into two categories: shape features, such as length, width, height, and distance. Because of the high similarity of the shape of electrical appliances, the method based on feature points is more effective. At the same time, the feature selection of feature points can also reduce the meaningless features and the overall variance of the model.

After extracting the image features, it is used to train the classifier. The basic process is to introduce the classifier module and train the classifier according to the feature data obtained after preprocessing. Call the SVM function of open CV component in Python to control the size of linear kernel and prevent over fitting. At the same time, pay attention to the implementation of multi classification. According to the image selected by the user, the identified types and brands of electrical appliances are displayed back to the user.

The main methods of image processing are: flipping, random cutting, color jitter, shift, scaling, contrast, noise, rotation, etc. This paper mainly uses the scaling change, brightness adjustment and grayscale to process the image. The algorithm of training the classifier based on the feature data is as follows：

1. Create image data for post-processing training
2. Create classifier CV2 ml.SVM_ create()
3. Determine the SVM type setType (CV2 ml.SVM_ C_ SVC)
4. Set kernel (CV2 ml.SVM_ LINEAR)
5. Utilization svm.train (train_ data, cv2. ml.ROW_ SAMPLE, train_ Label) to train the classifier

4. Conclusion

In this paper, the popular application needs of e-commerce enterprises are integrated with the image recognition technology based on deep learning. Markov random field algorithm is used to extract image features of a large number of electrical appliances

image sets. In the future, we will study how to optimize the Markov random field algorithm.

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