A Comparative Study on Circuit Recognition Paradigms for Sketched Electrical Circuit

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Abstract— It is a common practice for engineers to spend a considerable amount of time laying down initial concepts using pencil and paper. Typically, it requires additional time to transform the work into electronic media in the form of technical drawings. A sketch recognition program would save engineers much time redrawing these in technical software. In this research we will be recognizing sketched electrical circuit symbols. We want to achieve a trainable electronic sketched circuit recognizer that has fast response time, high accuracy and easy extensibility to new component. We will use PCA based image preprocessing and watershed segmentation method to segment circuit sketch.

Key words: Sketched Electrical Circuit, Circuit Recognition Paradigms

I. INTRODUCTION

It is a common practice for engineers to spend a considerable amount of time laying down initial concepts using pencil and paper. Typically, it requires additional time to transform the work into electronic media in the form of technical drawings. A sketch recognition program would save engineers much time redrawing these in technical software. In our project, we want to achieve a trainable electronic sketched circuit recognizer that has fast response time, high accuracy and easy extensibility to new component. Challenges in sketched symbol recognition lie in the different sketch styles of different users and various approaches have been made to solve this problem.

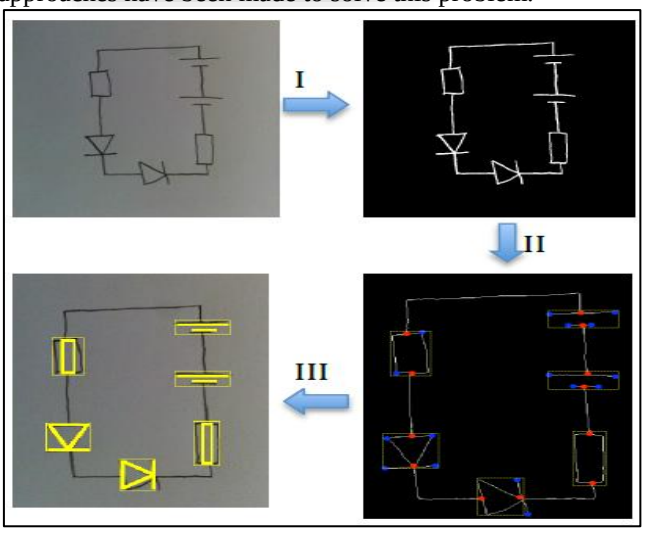

Fig. 1: Flow Diagram of CR System

To achieve scale invariance, rotational invariance and tolerance of different drawing types, we used Fourier descriptor of the boundaries of electronic component as feature vectors for SVM classification for recognizing the component. We also devised an efficient way of segmenting electronic circuits into individual components for recognition. To achieve scale invariance, rotational invariance and tolerance of different drawing types, we used Fourier descriptor of the boundaries of electronic component as feature vectors for SVM classification for recognizing the component. We also devised an efficient way of segmenting electronic circuits into individual components for recognition.

II. LITERATURE SURVEY

SouravPramanik has proposed a novel method to recognize a face sketch, based on extraction of facial components. In which for feature extraction geometric model used and K-NN classifier has been employed for classification. Nannan Wang, Jie Li, Dacheng Tao, Xuelong Li, XinboGao claimed that there existed two disadvantages for most available heterogeneous image transformation methods:

- The number of nearest neighbors is fixed which incurs blurring effect or brings in noise.
- Some important detail information or high frequency information loses due to average of overlapping areas.

Jie Wu1, Changhu Wang2, Liqing Zhang1, Yong Rui2 targeted at the problem of sketch recognition. They systematically studied how to incorporate users' correction and editing into isolated and full sketch recognition. This is a natural and necessary interaction in real systems such as Visio where very similar shapes exist. An algorithm was presented to construct the shape knowledge graph that encodes three typical editing modes, based on which, a novel isolated sketch recognizer was proposed for similar symbol differentiation.

Sheraz Ahmed presented an intuitive system for searching floor plans by using a sketch based interface. Furthermore, a complete system for automatic floor plan analysis is presented which is able to extract structural and semantic content of floor plan from given image. To represent the content of floor plan a graph-based semantic structure and associated visual query language is also presented in this paper. The recognition rates of sketch recognition as well as floor plan analysis are already good for the use in practice.

David Johnston presented a novel two-stage stroke grouping algorithm which does a fast initial grouping then refines these groups in an efficient way. Experiments suggest that this approach improves upon the techniques currently used in LogiSketch. Additionally, this grouping algorithm has the ability tighten the loop in the pipelined sketch recognition architecture.

Ramya R told that Noise from the input image is removed by Median filter, the segmentation process is done by K-means clustering algorithm and recognition of individual Simulink components from the input block diagram is done by Euclidean distance. The project aims to devise an efficient way to segment a control system block diagram into individual components for recognition.

Heng Yang propose a method for facial landmarks localization in 2D images of different modalities: face photos and face sketches. Based on the Cascaded Pose Regression framework, our model is jointly trained on both RGB images and synthesized sketch images, directly derived from the RGB images. The proposed method performs on par with the other RCPR variants and better than the other recent methods on RGB images. It shows significantly better results on sketch images from FSW dataset, collected in the wild, despite the fact that the model training is only based on the face photos and their synthesized sketches.

Yuchi Liu, Yao Xiao developed a method to recognize components in a sketched electronic circuit effectively. We utilized topology based feature point for segmentation. We used Fourier descriptor of the complex coordinates of the boundary of the component as feature vector for SVM. We have demonstrated a high accuracy recognition rate with invariance to image rotation, scaling and modification. Our system is extensible to recognize more categories of circuit component.

CaglarTirkaz describe a system that uses semi-supervised clustering followed by supervised classification for building a sketch recognition system that provides auto-completion. Our system approaches the auto-completion problem probabilistically and, although we have used a fixed confidence threshold during our tests, the confidence parameter can be modified by the user to specify the desired level of prediction/suggestion from the system. Experimental results show that predictions can be made for auto-completion purposes with high accuracies when the reject rates are close to that of a human expert. As described in the experiments, our system achieves 100.00% and 92.65% accuracies in the COAD database at human expert reject rates for full and partial symbols, respectively. For the NicIcon database, 93.26% and 87.63% accuracies are obtained without rejecting any instances for full and partial symbols, respectively. The system works in real time.

Y. Murali Mohan Babu, Dr. M.V. Subramanyamet. Al. said that Principal component analysis (PCA) is an orthogonal transformation that seeks the directions of maximum variance in the data and is commonly used to reduce the dimensionality of the data. In image denoising, a compromise has to be found between noise reduction and preserving significant image details. PCA is a statistical technique for simplifying a dataset by reducing datasets to lower dimensions. It is a standard technique commonly used for data reduction in statistical pattern recognition and signal processing. This paper proposes a denoising technique by using a new statistical approach, principal component analysis with local pixel grouping (LPG). This procedure is iterated second time to further improve the denoising performance, and the noise level is adaptively adjusted in the second stage.

III. PROBLEM IDENTIFICATION

Challenges in sketched symbol recognition lie in the different sketch styles of different users and various approaches have been made to solve this problem. Hence there is need to achieve scale invariance, rotational invariance and tolerance of different drawing types.

Reference	Feature Extraction	Classification	Recognition Performance
SouravPramanik et al.	Geometrical model used for predicted regions	K-NN classifier	92.4%
Nannan Wang et al.	Sparse feature selection (SFS) and SFS-based HIT algorithm	Nearest neighbors adaptively based on sparse representation	95%
Jie Wu et al	Shape knowledge graph	Isolated sketch recognizer	80.71%
Sheraz Ahmed et al	Symbol Spotting and Graph Matching	Semantic Analysis	85%
CaglarTirkaz et al.	Not specific mentioned	Expectation Maximization (EM) algorithm	95%
Vincenzo Deufemia et al.	Latent-Dynamic Conditional Random Field (LDCRF), a discriminative model	distance-based clustering algorithm	81%
SouravPramanik et al.	Geometrical model used for predicted regions	K-NN classifier	92.4%

Table 1: Comparison

IV. CONCLUSION

The phenomenal development of tourism related multimedia data in the Internet, such as the GPS-tagged photos and tour guide web pages, has optimistic computer vision investigators to think about landmarks globally. Here, we try to build a world-scale landmark identification engine, which organizes models and recognizes the landmarks on the scale of the entire planet Earth. Constructing such an engine is, in real meaning, a multi-source and multi-modal data mining task. Henceforth we need to analyze existing techniques. The objective of the mobile identification system is to analyze the effectiveness of the landmark recognition framework in a real world scenario, and to collect user feedback on the effectiveness and accuracy of the framework. In comparison table we have compared different literatures and find out some bottlenecks in existing techniques. In problem identification section we have mentioned some tailback of existing techniques such as Monulens, Google Goggles if these tribulations can be solved then performance will increase.

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