2003 TAIWAN INTERNATIONAL SCIENCE FAIR

CATEGORY：Computer Science

PROJECT TITLE ：Automatically Categorizing Commercial Segments Using Multiple Computer Vision Techniques

AWARD：second Award

SCHOOL：Lake Brantley High School

FINALISTS：Joseph Patrick Wilson

COUNTRY：United States of America

Automatically Categorizing Commercial Segments Using Multiple Computer Vision Techniques

Joseph Patrick Wilson

The purpose of Computer Vision is to understand the methods by which humans process visual information and likewise to create computer algorithms similar to these processes. Through careful observation, a computer algorithm was developed to mimic how humans recognize logos in television commercials. After visual analysis of numerous commercial sequences, it was hypothesized that the key frames (frames in which the logo resides) could be found using the intersection of color histograms; the logo region could be found using the edge density within the key frames; and the logo could be identified utilizing a correlation method with a database of stored logos, scaled to different levels using Bilinear Interpolation.

Color histograms were implemented using one-dimensional arrays with 24 bins; key frames were determined by calculating the intersection between consecutive frames' color histograms. The edge density was calculated by convolving the key frame with the number of edge pixels within a 21X21 area. The identification of the logo was determined by computing the Sum of Square Differences between the logo region and the database of logos on different scales; SSD values were normalized for different scales.

The algorithm was tested on 14 different sequences and determined the key frame with 80% accuracy. By segmenting the sequence into two key frames, the algorithm generated 93% accuracy. The algorithm also identified the logo region with 93% accuracy. The identification of the logo yielded anomalous results. These data suggest that motion between consecutive frames in commercial segments decreases around the display of the logo. They also suggest that the logo region has the most visible edges within the key frame.

Future study includes a complete overhaul of the logo recognition algorithm. The correlation algorithm (SSD) does not work accurately enough to be used. Therefore, the next step is possibly to look at the edge information about the key frames. As the Canny algorithm determines the edges of an image, it has to determine the direction (or orientation) of the edges. Therefore, a proposed study includes utilizing an edge orientation histogram of the database of the logos and the key frames. This would mean that the algorithm would identify the logo in the key frames by matching edge orientation histograms.

評 語

1. An interesting pattern matching algorithm which can locate logos even under rotation.
2. Excellent implementation of algorithms with original contribution. Normalized cross-correlation is a good direction to explore.