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Content Based Image Retrieval

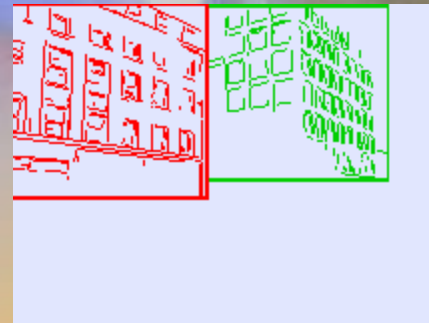
- Content Based Image Retrieval or CBIR for short is a technique of searching through a database of images not based on keywords but image content
 - How does one describe image content without keywords?
 - Using images, colors or textures.

CBIR: What is the need?

- In today's world more and more multimedia information is stored in databases.
- We need a way to search through this information quickly
- We need a fully automated search tool to save time.
 - In the past images in databases were looked at and categorized by human auditors.
 - The process of manually categorizing images is time consuming, expensive and tedious.

CBIR: An Automated Approach

- How can we build a tool that will automatically search through an image database and produce meaningful results?
 - We first must have a meaningful way to compare images in the database to the query,
 - We can compare: colors, shapes, textures, image contents.

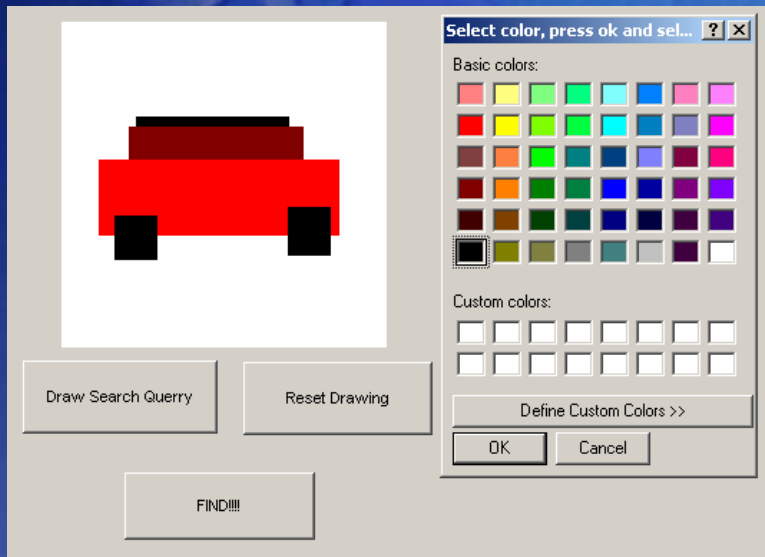


Simple CBIR: Proof of Concept

- It is easy to build a simple CBIR application that performs fairly well and runs in near real-time
- We chose to compare based on color and shapes because it is very fast
- First a query image is drawn
 - It consists of a color representation of the images we are looking for

Simple CBIR: Example

- A sample query image and result:



Simple CBIR: Algorithm

- Preprocessing step 1:
 - All images put into database must be preprocessed in order to speed up the search algorithm.
 - Images are first resized to 20x20 pixels
 - This size was found through trial and error.
 - It is small enough to greatly increase algorithm speed
 - It is also big enough to retain important image characteristics

Simple CBIR: Algorithm

- Preprocessing step 2:
 - Images are reduced to 4 colors
 - This step is very important to cater to the humans using this system
 - Example: you want to search for image of grass, so you make the query canvas green. The assumption that grass is green is perfectly reasonable, but in most images of grass the green consists of about 16 million shades of green brown black and other colors.
 - If the image colors are not reduced the algorithm tends to return results that are less meaningful to humans

Simple CBIR: Algorithm

- Preprocessing step 2 continued:
 - Color reduction will also reduce noise as a side effect
 - The final image will consist of only the most prevalent four colors in the original image
 - Usually this is what we want anyway, if we are looking for a red car on a brown parking lot we only care about the red and the brown
 - Four colors were chosen through trial and error.

Simple CBIR: Algorithm

- Searching:
 - Image subtraction is used because it is fast and produces a meaningful error value
 - Absolute error is used instead of mean squared error because it is faster to compute
 - The query image is compared to every image in the database and error values are obtained
 - The images with the 3 smallest errors are displayed as matches

Simple CBIR: Conclusions

- Current implementation runs reasonably well producing meaningful results with images that are not very complex
- Users learn how to create better search queries after repeated use.
- Because image subtraction was used as a comparison measure, the program can run in near real time.

End

