DUPLICATE IMAGE VERIFICATION & ELIMINATION (DIVE) USING DCT

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For: MAT 201A taught by Dr. Jerry Gibson
Motivation

• Night of the Reunion: Lots of digi-cams around, trigger-happy fingers go clicking everything

• The Day After: You want the snaps of the reunion!

• Issue: Too many images that look the same or worse still, are actually same! Clumsy to handle so many of them.
Day at the Zoo: Your lucky day, all the animals are posing for pics.

Grabbing the rare chance you take multiple hi-res shots of everything possible...even the blades of grass!!!

Issue: Too many pics, too less info, not enough storage space.
In all likelihood you are capturing the same information repeatedly.

Else you might be capturing a marginal difference which is not discernible to the visual perception in any case.

Besides, storage space comes at a price...
Proposed Solution

★ Have a computer program sieve through your suspect database of images and identify the “basis” set of images.

★ Basis: Mathematically, a term from Linear Algebra meaning a representation of an entire space through a linearly independent set of elements.
The “Unique” Idea

- The Fourier Transform is unique!
- The Discrete Cosine Transform (DCT) is a variant of the above with only the real parts (we don’t see imaginary things!)
- An image can be thought of as a linear combination of varying frequency components.
Every image will have a distinct DCT signature.

Evidently then identical images will have the same signature (DCT value).

Consequently, similar images will have signature's very close to each other.
Assumptions

Same Images of different sizes are considered as “duplicates”
All the above images represent “Lena”. But all three are “Unique”!
Implementation Details

- Images can be of varying sizes and still convey the same visual information. We don’t want this.

- Resize the images in MATLAB to a normalized size, say 64 x 64 for ease of comparison.
Contd...

* Comparison done on the basis of the DCT value of the image. But the DCT value contains the information of the image in a matrix format. How do we compare a matrix to another matrix??

* Hints: Given a square, full-rank matrix!
The Similarity Transform

* $X'AX$ - The “similarity transform” generates a unique scalar for a unique $A$ matrix. This value is a measure of the “magnitude” of the matrix and can be used for comparison with other similarly transformed DCT matrices of other images.
If the $X'AX$ value of various DCT matrices are the same or are within a specified threshold range, only one amongst that entire set is chosen.

The $X$ here is a vector of “ones”.
DCT perceives apparently like images as distinct images.

Two images that look the same to you might not mathematically be so!

One likely Solution can be - Pattern Recognition...
The Discrete Cosine Transform lends a neat and simple solution to the problem of identifying and eliminating redundant images.

But there’s a limit to its accuracy!
THANK YOU!

Any Questions?