

Magic Camera

Master's Project Defense
By
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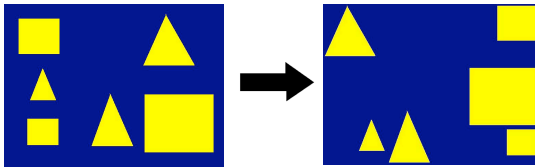
Project Committee:
Dr. Eamonn Keogh
Dr. Doug Tolbert

Roadmap

- Problem
- Motivation
- Background
- Stepping Through Magic Camera
- Results
- Conclusion
- Future Work

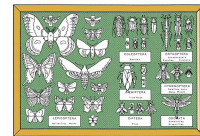
Problem

- To organize an image containing a collection of objects in front of a solid background



Motivation

- Incorporation into Digital Cameras
 - Sorting Tables
 - Insect Boards



Background

- Multidimensional Scaling (MDS)
 - Transforms a dissimilarity matrix into a collection of points in 2d (or 3d) space
 - Euclidean distances between the points reflect the given dissimilarity matrix
 - Similar objects are spaced close together, dissimilar objects are spaced farther apart

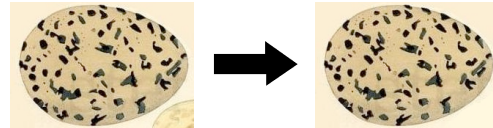
Stepping Through Magic Camera

- Identifying Objects
- Calculating Similarities
- Creating Resulting Image

Identifying Objects

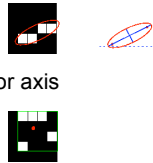
- Convert to black and white image
 - Threshold: calculated automatically or specified
- Each connected comp treated as an object
- Each obj. cropped by B-box + 5 pixel border
- Edges of adjacent objects filtered out
- Objects rotated to “face” same direction

Filtering Adjacent Objects



Object Rotation

- Find major axis
 - Align with image's major axis
- Find centroid
 - Rotate so centroid is at bottom/left of obj



<http://www.mathworks.com/access/helpdesk/help/toolbox/images/regionprops.html>

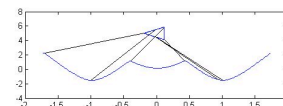
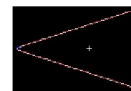
Calculating Similarities

- Numerical representation of objects
 - Shape, color, texture
- Create dissimilarity matrix
 - Euclidean dist between each pair of objs

Shape

- Each object translated into a time series
- Dist from the center of obj to perimeter
 - Code provided by Dr. Keogh

Shape II



Color

- RGB values independently averaged
 - 1000 random pixels chosen
 - Pixels not unique (if obj < 1000 pixels)

Texture

- Std deviation of 9 pixel neighborhood
 - averaged over 1,000 random pixels
 - Pixels not unique (if obj < 1,000 pixels)



Creating New Image

- Extracting Background
- Finding New Positions
- Fixing Overlaps

Extracting Background

- Use B&W image to id background
- Independently avg RGB values
- Create a new solid background image
 - same dimensions as original image

Finding New Positions

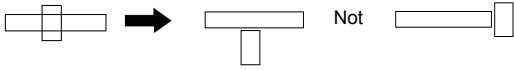
- Use MDS to get coordinates for objs
 - Using dissimilarity matrix
- Reverse Y values
 - Images are indexed top-down



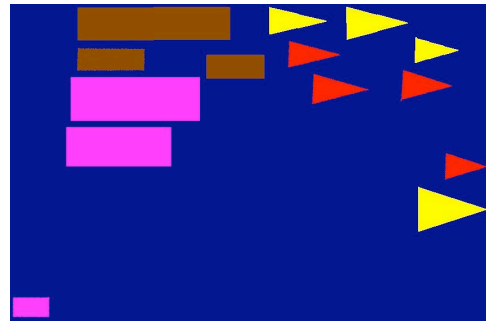
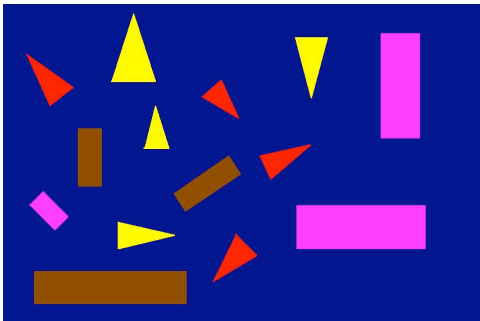
Fixing Overlaps

- Start placing objects in given order
 - Randomly chosen if not specified
- If overlap detected
 - Move object min dist to rectify
 - In one direction (up, down, left, right)

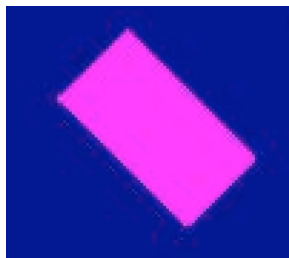
Fixing Overlaps II



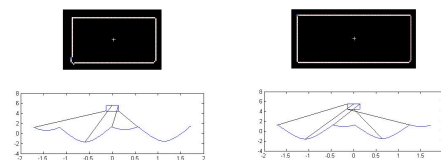
Results

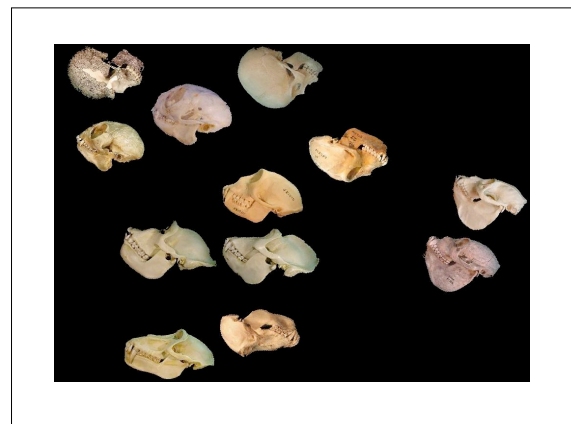
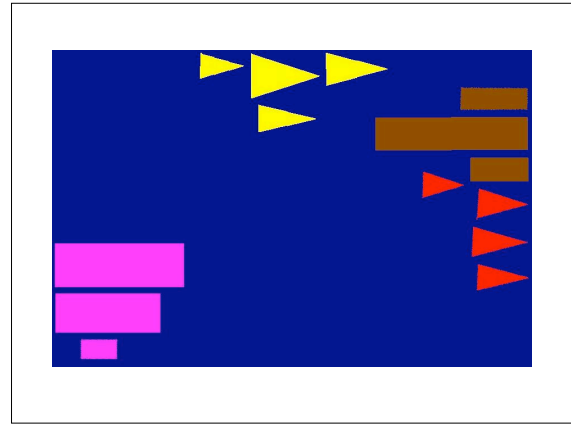
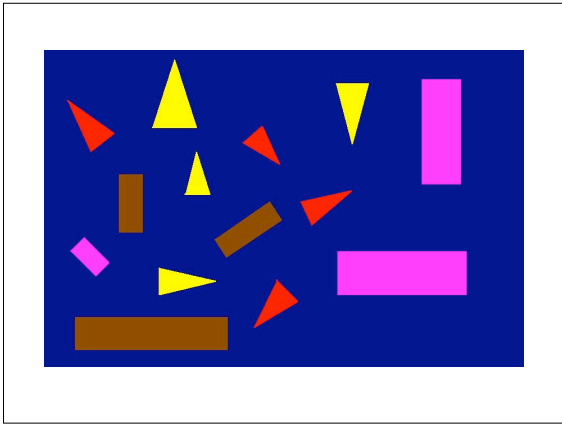


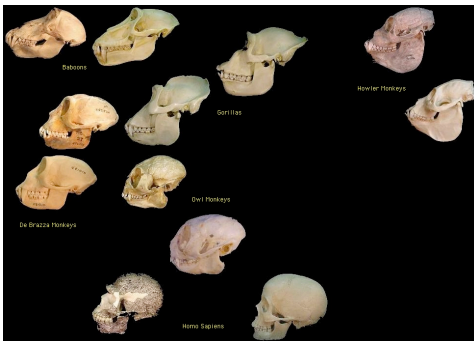
Explanation



Explanation II







Conclusion

- Input image
 - Collection of objects on solid background
- Output image
 - Similar objects grouped close to each other
 - All objects “face” same direction

Future Work

- Develop color method
 - Try it with some real data (butterflies, etc.)
- Add combination of similarity measures
 - Shape & color, color & texture, etc.
- Add optional How-To
 - Display original image
 - User clicks an object
 - Line drawn to new location

Questions ?