VFX Project #2: Image Stitching

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March 28, 2006

Outline

- Feature detection
- Feature matching
- Image matching
- Bundle adjustment (optional)
- Image blending

Feature Detection

- You need to implement this part by yourself.
- You can choose from Harris corner detector, SIFT or MSOP.
- You can download the SIFT demo program at
  http://www.cs.ubc.ca/~lowe/keypoints/

Feature Output

- Features are treated as high dimensional vectors.
- Take a look at `FeatureSet.h` and `FeatureSet.cpp`. They contain basic I/O for features.

Feature Matching

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- Add your own feature matching routine and modify `initGlobalAlign()` defined in `GlobalAlign.cpp`.
- This is the most time-consuming step!
  - $O(n^2)$ comparison if there are n features,
  - SIFT usually finds > 1000 features in an image.

Accelerate Feature Matching

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2. Use faster searching structure, such as KD-tree.
   - You can use the ANN library which implements KD-tree.
     http://www.cs.umd.edu/~mount/ANN/
   - O(n log n) to find all matching pairs.

Image Matching

- Calculate the transform matrix according to matched feature pairs.
- Use RANSAC to drop outliers.
- You'll need to solve/fit linear systems here.

Image Matching Routines

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Image Matching Routines

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- `countInliers()`: Given f_1, f_2 and M, count the number of inliers in the feature set.
- `leastSquareFit()`: Given those inliers in f_1 and f_2, calculate the final M by linear fitting.

These three functions are defined in `FeatureAlign.cpp`.

Bundle Adjustment

- `bundleAdjust()` defined in `GlobalAlign.cpp`.

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- Sorry that I can't help. You can make this function do nothing since bundle adjustment is not required.

Image Blending

- Our code only provides a skeleton of simple linear blending.
- Feel free to rewrite `BlendImages()` defined in `BlendImages.cpp` if you want to implement other algorithms.

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- `NormalizeBlend()`: divide the intensity by the weight for each pixel.

Some Other Routines

- `WarpRDField()`: radial distortion correction.
- `WarpSphericalField()`: warp planer coordinates to spherical coordinates.

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The results of these two functions are `FloatImage2` which contain inverse warpping coordinates.

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  - Let us know if there are any bugs.