Photomosaic Image Stitching Using SIFT Features

Liz Del Cid
EGGN 512 Computer Vision
Colorado School of Mines
Image Mosaics (stitching)

Objective:
• blend together several overlapping images into one mosaic (composite)

Inspiration:
• Multiple images can give us depth and 3D structure
  o Stereo Vision
  o Shape carving
  o Structure from motion
For each pair of images:
1. Extract SIFT features
2. Match Features
3. Estimate homography
4. Transform 2\textsuperscript{nd} image
5. Blend two images
6. Combine images
Blending Images

Problem:
Seams are produced when adjacent pixel intensities differ in stitched images due to changed lighting conditions or the vignette effects. (a reduction of an image’s brightness or saturation at the periphery compared to the image center)

Solution:
Image pyramids
Pyramid Blending

Laplacian pyramid is an algorithm using Gaussians to blend the image while keeping the significant features. It resizes the image into different levels (sizes) with Gaussian. Then expands the Gaussians into the next level and subtracts from the image in that level to acquire the Laplacian image.
After creating the Laplacian pyramids for each image, combine the two images in different Laplacian levels by combining partial images from each of them.
Pyramid Blending (continued)


Pyramid Blending Test

Image Splicing: Laplacian Pyramid

Image splicing: no blending
Combining Images

After transforming the second image

- **Canvas Creation and Placement:**
  - The images are placed on identical sized canvases and then combined to create the final image.

  \[
  [\text{transimg xdata ydata}] = \text{imtransform(img2, TFORM)};
  \]

  - \text{xdata} and \text{ydata} are both vectors of two integers. The first integer of each array is the offset of the initial point of the transformed image. This information along with the image sizes allowed for not only the summation of the transformed and static images, but also for an adequately sized canvas for the resultant image.

- Michael Carroll and Andrew Davidson. “Image Stitching with MatLab”. Louisiana State University. Department of Electrical and Computer Engineering
Combining Images (continued)

- For proper image alignment, chose one of four different cases to construct a dynamic canvas. The four cases are:
Combining Images (continued)

- Final step:

  \[-\text{imadd()} / \text{imssubtract()}\]

- These allow for the combining of the transformed and static image to create the output image canvas.

- \text{imssubtract()} is first used to clear out the overlapping area of the final image.

- \text{imadd()} then appends the difference between the images to the area that was overlapping while keeping the result from \text{imssubtract()}. 
My Results

≈22 images

16 images
Recognizing Panoramas
Recognizing Panoramas

System components

• Feature detection and description
• Fast matching (hash table)
• RANSAC filtering of matches
• Intensity-based verification
• Incremental bundle adjustment

Matching Mistakes

• Accidental alignment
  o repeated / similar regions

• Failed alignments
  o moving objects / parallax
  o low overlap
  o “feature-less” regions
More Panoramas
Bibliography


• Michael Carroll and Andrew Davidson. “Image Stitching with MatLab”. Louisiana State University. Department of Electrical and Computer Engineering


Questions?