NTU 2021 Spring Final Project Proposal

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A. Paper Title

Rectangling Panoramic Images via Warping

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B. Motivation

Because the limitation of digital camera, a digital image can only have a limited field of view(FOV) and less description of the scene even than human eyes. We are interested about how to make the scene more descriptive, for example, panorama. In addition, a panorama can be used to be a surrounding background in a 3D scene. Consequently, we want to research how to stitch images to get a panoramas and optimize the result by rectangling panoramic images via warping.

C. Problem Definition

1. How to find the feature points of an image and stitch those images according to these feature points.
2. Because the fluctuations of the camera when taking photos and

there may be some errors when matching the feature points, we often can't directly get a perfect rectangular result, however, we always desire our images to be rectangular.

3. Cropping the images to the maximum rectangle will lose a lot of information. We need to find a better method to warp the image to a rectangle region appropriately without visible distortions by human eyes.

D. Algorithm

Step1. Find the feature points of all input images

Step2. Match the feature points of two consecutive images and merge them all into a big panorama.

Step3. Mesh-free Local warping: warp the image into a rectangle by **Seam Carving Algorithm**. That is a DP method to fill up all missing pixels.

Step 4. Draw meshes on image in step 3 and warp it back to the original image. Record the translation of each mesh point.

Step 5. Mesh-free Global warping: Optimize the energy of each mesh points by **alternating algorithm**. The energy function is:

$$\mathrm{E}(\mathrm{v},\{\theta_{\mathrm{m}}\}) = E_s(V) + \lambda_L E_L(\mathrm{V},\{\theta_{\mathrm{m}}\}) + \lambda_B E_B(V)$$

V can be optimized by fixing θ_{m} and solving a linear system.
θ_{m} can be optimized by fixing V and minimize:

$$\min_{\theta_m} \sum_{j\in bin(m)} \left\| C_j(\theta_m e_{q(j)} \right\|^2$$

Step 6. Stretch the image and post-processing.

E. Expected Results

Input Image 1

Output Image 1

Input Image 2

Output Image 2

F. References

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