3D Reconstruction Tool based on Multi-View images

Hongyi Rao (raohy@bu.edu), Jiahao Wang(uf6@bu.edu), Yiqin Zhang(evezhang@bu.edu)

Background

Multi-view stereo (MVS) uses multiple images taken by one/multiple camera(s) to reconstruct the 3D scene.

Our goal is to create an Assisted Modeling Tool to meet the needs of designers, game developers, architects, engineers, and people who frequently do modeling.

Next Step

- Increase the accuracy, especially the algorithm to get extrinsic parameters.
- Reduce the running time.
- Achieve the performance without converting the resolution of the input image.
- Construct an interactive user interface.

Method

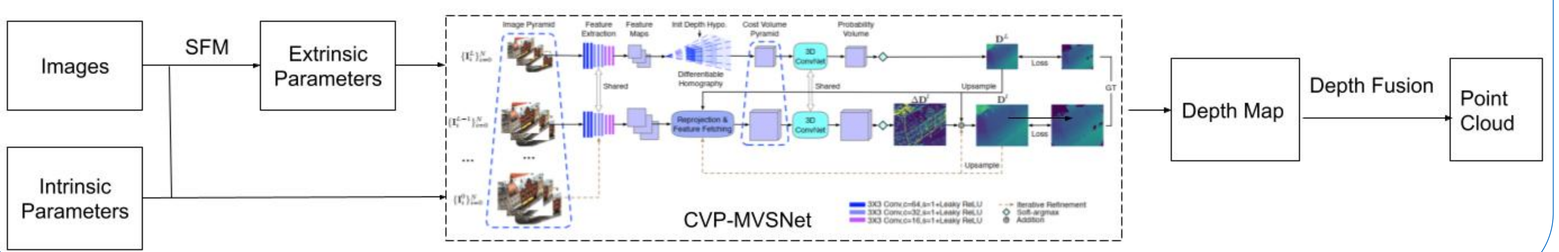
The method we adopted is shown in the figure below.

SFM (Structure from motion):

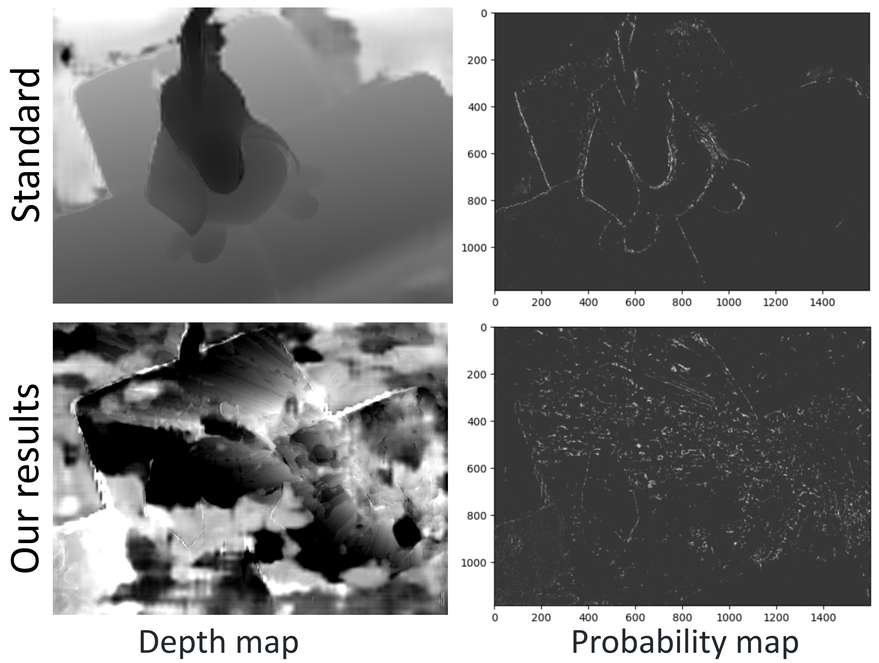
1. Use SIFT to get corners that represent image's features.
2. Take the first picture as a reference, the corner points of the reference picture and the input picture are matched to obtain ten pictures with the most similar features.
3. Obtain extrinsic parameters of the most similar image through matching points and initialize a 3D model.
4. Based on the 3D model, use reprojection to obtain extrinsic parameters of other images.

- Input the obtained extrinsic parameters, together with images and intrinsic parameters, into the CVP-MVSNet to generate depth maps.
- Fuse multiple depth maps to form the point cloud model.

Intrinsic parameters: the focal length and lens distortion, etc.
Extrinsic parameters: describe the transformation between the camera and its external world.



Result



- Due to the slight error of the camera's extrinsic parameters obtained by SFM, the image block is shifted and misaligned.
- The SFM algorithm causes the error of the camera's extrinsic parameters to gradually add up, which should be improved in the future.

Depth map: reflects object distance from the origin.
Probability map: reflects depth estimation quality.

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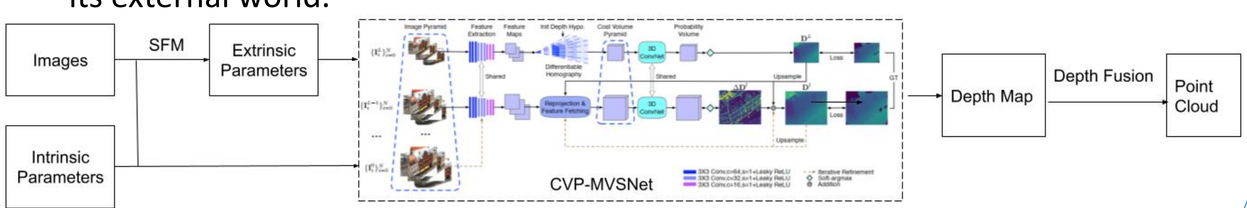

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Result

Standard

Our results

depth map probability map

- *Due to the slight error of the camera's extrinsic parameters obtained by sfm, the image block is shifted and misaligned.*
- *The Sfm algorithm causes the error of the camera's extrinsic parameters to gradually add up, which should be improved in the future.*