

CS445 Final Project

Painting Walls in 3D

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GOAL - Paint Walls in 3D



Why warp is important



Structure From Motion (COLMAP)



Obtain Projection Matrix

1. Get Annotated 3D coordinates of points on one plane.
2. Find a 3D plane equation by using RANSAC.
3. Obtain Projection Matrix between 3D plane and the image.

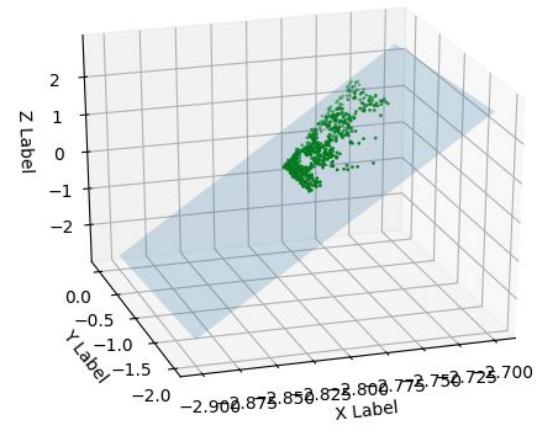
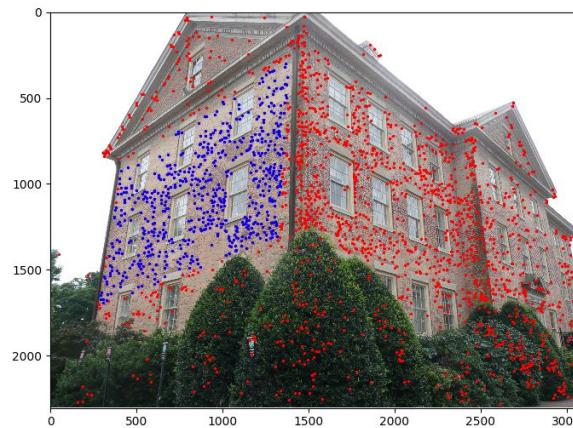
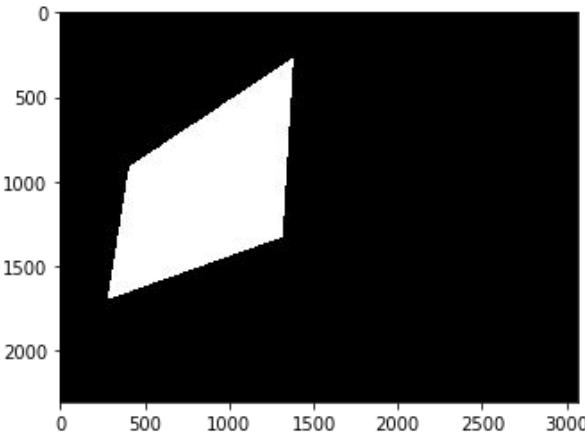
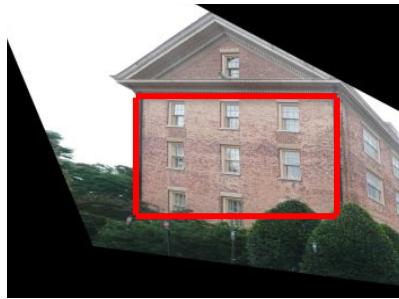


Image Transformation Pipeline



Warp
Perspective



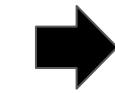
Paint



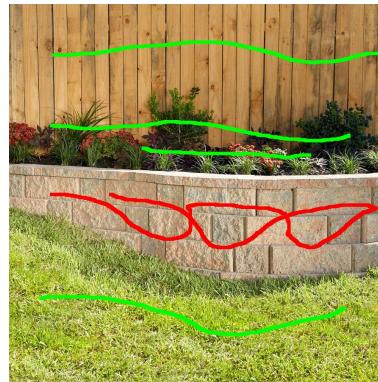
Transform warped image
to original image plane



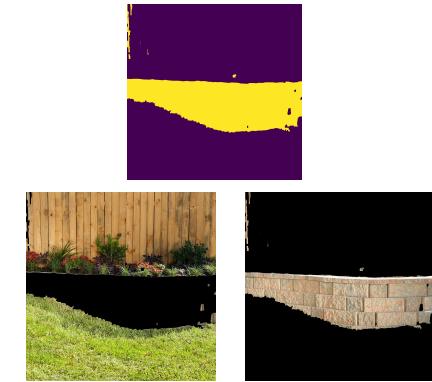
Wall Painting Pipeline



Annotate



Segmentation



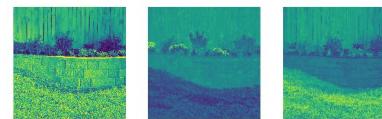
Gradient Domain
Fusion with Mixed
Gradients



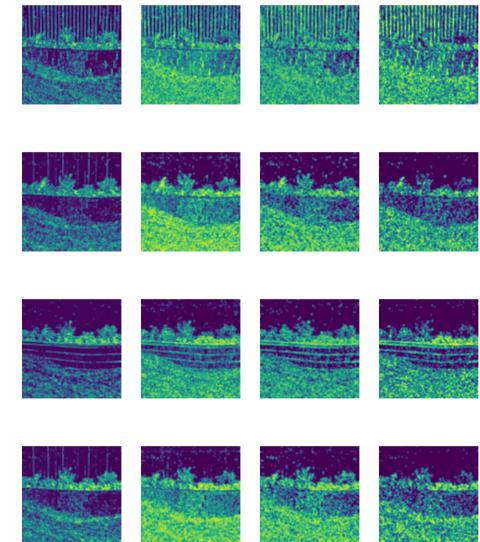
Wall Segmentation (Feature Extraction)



Feature
Extraction

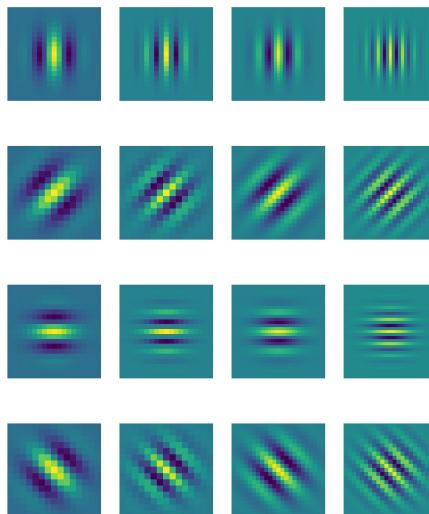


Intensity and Color
Information

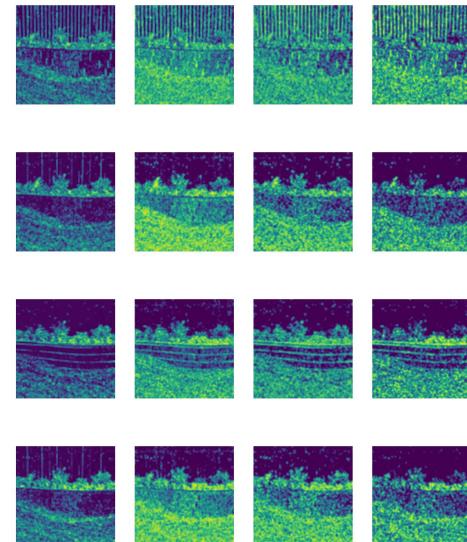


Texture Features

Wall Segmentation (Gabor Filters)

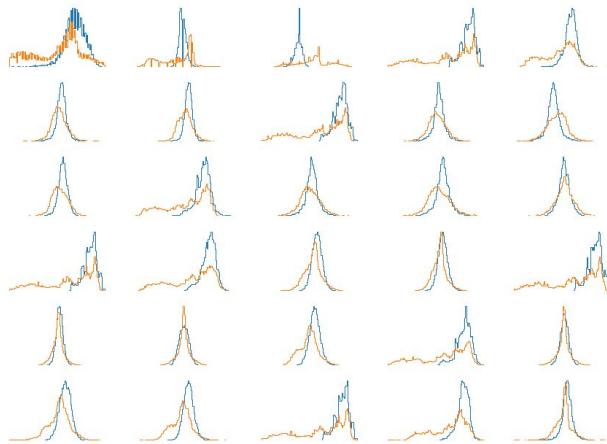


Combination of Gaussian and
Harmonic Filter at Different Angles
and Frequencies

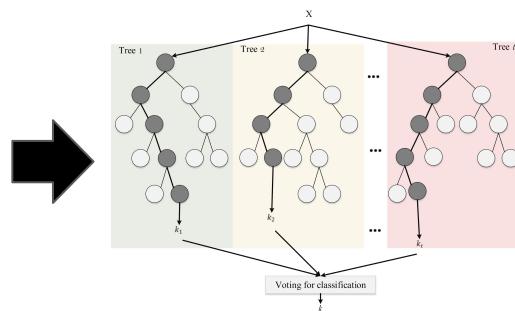


Local Texture Information

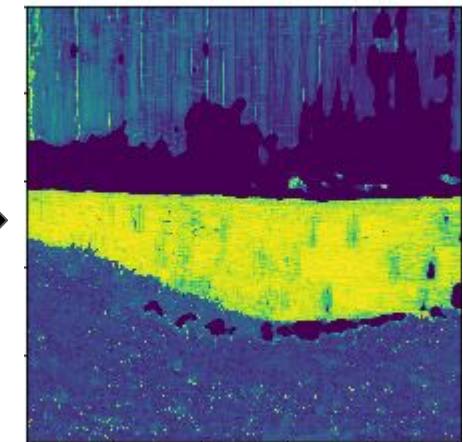
Wall Segmentation (Pixel Classifier)



Response of foreground and background pixels for different features.

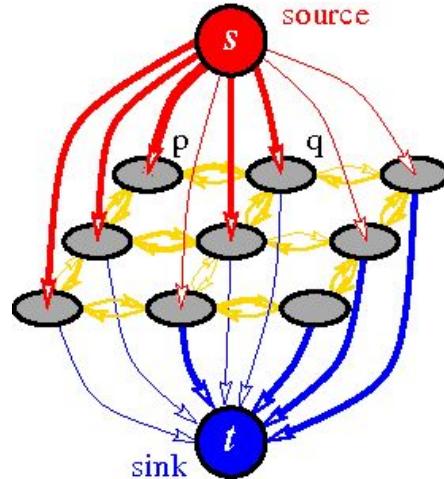
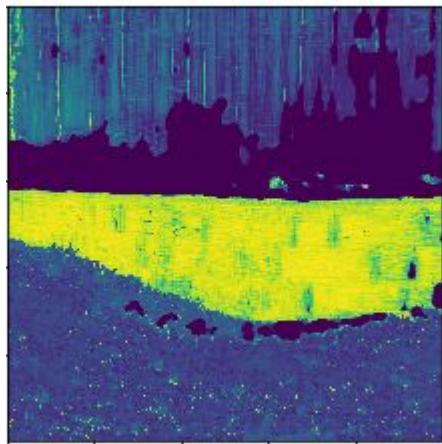


Random Forest Classifier



Probability Density Map
for Foreground Pixels

Wall Segmentation (Graph Cut)



Obtain precise
boundaries using
graph cut

Result 1



Laplacian Blending



Gradient Domain Fusion using
Mixed Gradients

Result 2



Laplacian Blending



Gradient Domain Fusion using
Mixed Gradients

Major Challenges

- Model for foreground and background pixels should be pretty good for the graph cut to work well.
- Hard to obtain proper Plane equation and Projection Matrix due to the noise of the sparse point cloud.
- Drawback of mixed gradient domain fusion: background color of the painting should be close to the average color of the wall, else it produces artifacts in the image.
- A lot of manual annotation is required to produce a working result.
- Full pipeline takes a lot of time to execute and has high chances of failure.

Failure Cases



Wrong Projection matrix



Errors in Segmentation
due to lighting effects



Parallelogram instead of rectangle



Unable to exclude
pixels with similar
texture as
foreground from
the segmentation

