# Seam Driven Image Stitching

PROJECT ID - 30


TEAM MEMBERS -

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# INTRODUCTION

- **Image stitching** or **Photo stitching** is the process of combining multiple photographic images with overlapping fields of view to produce a segmented panorama or high-resolution image.
- This is done by aligning multiple images based on the best geometric fit of feature correspondences between overlapping images. Seam-cutting is used afterwards to hide misalignment artifacts.

# GOAL

- The traditional method of image stitching is quite naive and does not produce the best results of panoramic images.
- We wish to generate a new method of image stitching where seam cutting is applied beforehand on the homography and stitched image with the best score is selected, which gives us much better results than the traditional method.

# PRE-REQUISITES

# HOMOGRAPHY

- Homography is a perspective transformation of a plane, i.e. a reprojection of a plane from one camera into a different camera view, subject to change in the translation (position) and rotation (orientation) of the camera.
- Perspective transformations map 3D points onto 2D image planes using the transformation matrix that incorporates the camera characteristics: focal length, optical centre, and the extrinsic parameters (rotation, translation) .

# Scale Invariant Feature Transform SIFT

- The scale-invariant feature transform (SIFT) is a feature detection algorithm in computer vision to detect and describe local features in images.
- This is a robust algorithm that evaluates various keypoints known as features in an image. Each keypoint is represented as a 128-dimensional vector storing information about orientations, gradients.

# Random Sample Consensus RANSAC

- RANdom SAmple Consensus  (RANSAC)  is a robust and iterative technique to estimate parameters of a mathematical model from a set of observed data that contains outliers, when outliers are to be accorded no influence on the values of the estimates.
- Here we use this algorithm to generate homographies that best fits the model.

# Markov Random Field
# MRF

Minimize the following expression -

$$E = \sum_{p} E_d + \lambda \sum_{(p,q) \in N} E_s$$

Where Ed represents data cost energy, Es is smoothness energy which measures the discontinuity of adjacent pixels, p and q, defined over a 4-connected neighborhood N -

$$E_d(p, l_p) = -\nabla I_{(l_p)}$$

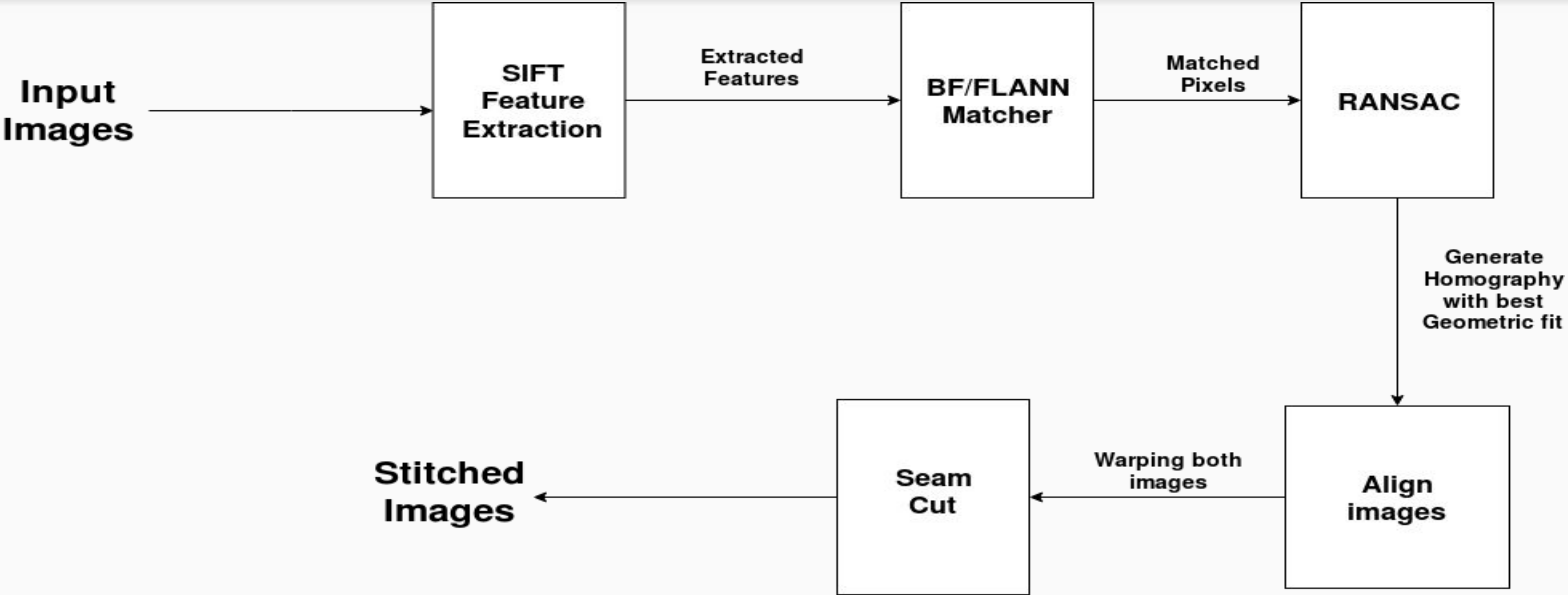
$$E_s(p, l_p, q, l_q) = \left| l_p - l_q \right| .(D(p) + D(q))$$

$$D(v) = \| I1(v) - I2(v) \|^2 + \alpha \| \nabla I1(v) - \nabla I2(v) \|^2$$

# Traditional Method for Image Stitching

- The traditional method of image stitching is quite naive and does not produce the best results of panoramic images.
- It follows a simple pipeline of extracting SIFT features from the images and matching them using BF or FLANN matcher.
- The corresponding pixels are passed into the RANSAC algorithm to generate the homography with the best geometric fit.
- The generated homography is used to align the images and apply seam cut on them to stitch the images.

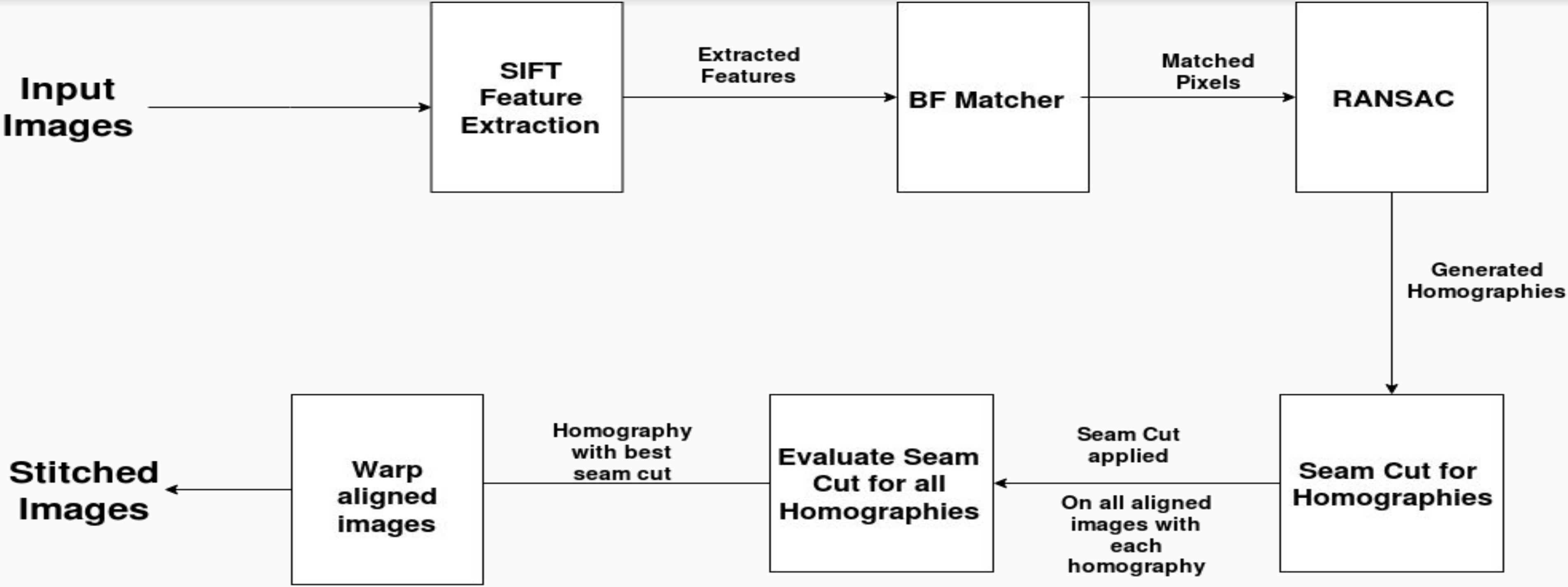
# Traditional Method for Image Stitching - Pipeline



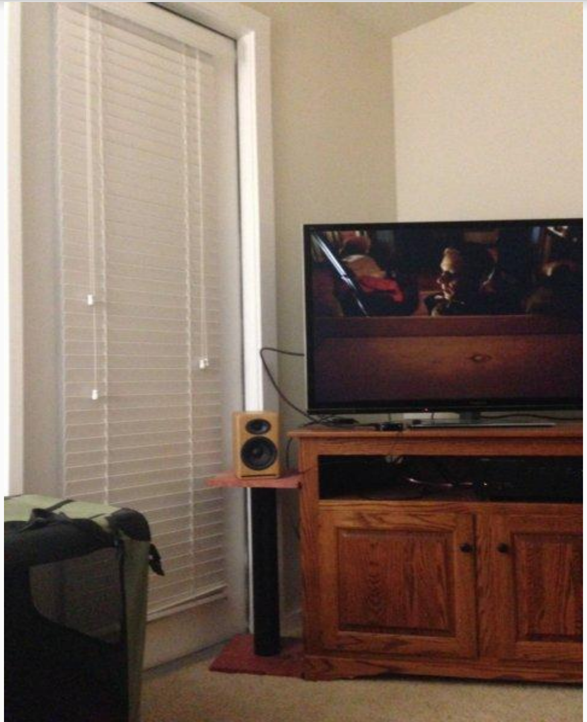
# IMPLEMENTATION

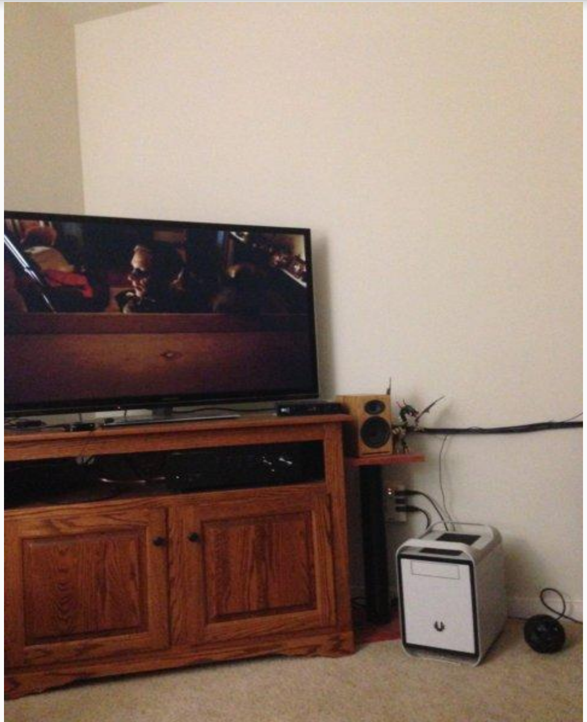
- SIFT algorithm is used to generate features in both images.
- BFMatcher returns a correspondence matrix which matches the features.
- Matched feature vectors as correspondence matrix are fed into RANSAC.
- We construct homography matrix from 4 random points.
- If distance is greater than threshold, they are considered outliers otherwise they are inliers.
- Aim of RANSAC is to maximize the inliers. So in the hypothesize and test loop, homography with minimum global energy , using Markov Random Field as a labeling problem, after applying seam cut is used to align both images.

# OUR ALGORITHM - PIPELINE



# COMPARISON WITH TRADITIONAL IMPLEMENTATION ORIGINAL IMAGES

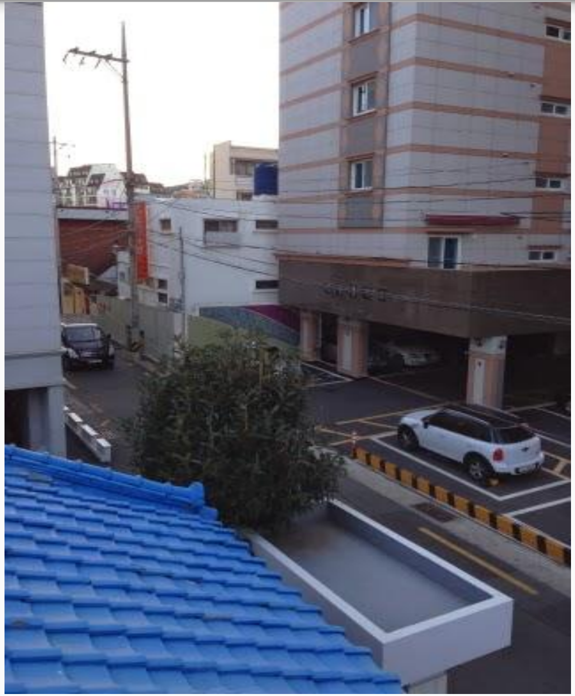




## Algorithm

## Traditional Method

# COMPARISON WITH TRADITIONAL IMPLEMENTATION ORIGINAL IMAGES



Algorithm

Traditional Method

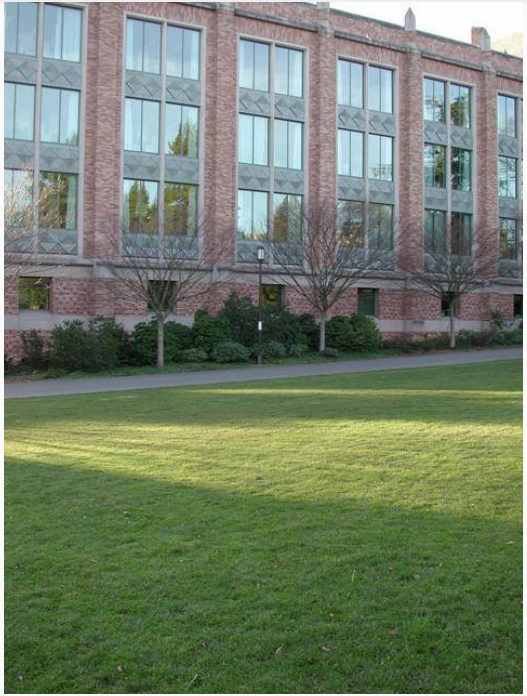
# RESULTS FOR MORE IMAGES
# ORIGINAL IMAGES

# RESULT

# ORIGINAL IMAGES

# RESULT

# ORIGINAL IMAGES



# RESULT

# THANK YOU