**Department of Electrical Engineering**

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| **Faculty Member:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Dated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
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| **Course/Section:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | **Semester: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
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**CS-477 Computer Vision**

**Lab#11: Image stitching-An open ended Lab**

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|  |  | **PLO4-CLO4** | **PLO5-CLO5** | **PLO8-CLO6** | **PLO9-CLO7** |
| **Name** | **Reg. No** | **Investigation**  **(5 marks)** | **Modern Tool Usage**  **(5 marks)** | **Ethics**  **(5 marks)** | **Individual and Team Work**  **(5 marks)** |
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**Lab#11: Image stitching**

**Objectives:**

**The objective of this lab is to stitch two images to create panoramic image.**

**Lab Instructions**

* This lab activity comprises of following parts: Lab Exercises, and Post-Lab Viva/Quiz session.
* The lab report shall be uploaded on LMS.
* Only those tasks that are completed during the allocated lab time will be credited to the students. Students are however encouraged to practice on their own in spare time for enhancing their skills.

**Lab Report Instructions**

All questions should be answered precisely to get maximum credit. Lab report must ensure following items:

* Lab objectives
* Python codes
* Results (graphs/tables) duly commented and discussed
* Conclusion

# Introduction

Image stitching stands as a technique to craft composite images, such as panoramic views, by combining multiple overlapping photographs. This method extends the capacity to capture more information and construct a broader field of view compared to the limitations of a single image. Industries spanning photography, virtual reality, and robotics extensively leverage image stitching.

This innovative process allows the creation of seamless panoramas, offering viewers a continuous perspective of expansive landscapes or architectural wonders. Panoramas serve as a medium for preserving and encapsulating the beauty of a scene, surpassing the constraints of a solitary frame. For photographers, image stitching becomes a tool to showcase the grandeur of mountain ranges, the vastness of open fields, or the intricate details of architectural marvels.

The applications of image stitching extend beyond aesthetics, finding utility in diverse domains such as large-scale mapping, 3D scene reconstruction, and even medical imaging, where overlapping scan slices are seamlessly fused. Roboticists employ image stitching to generate panoramic maps for navigation and visual localization.

Exploring the multifaceted applications of this technology unveils the potential to create breathtaking panoramic photographs by understanding the image stitching process and harnessing the capabilities of OpenCV.

# Image Stitching Pipeline

Creating a seamless composite from a collection of distinct photos involves a systematic breakdown of the image stitching process into several crucial steps, forming a comprehensive pipeline. The precision of alignment and blending is pivotal at each stage. This section provides an overview of the foundational principles and techniques employed in the step-by-step image stitching pipeline.

The key components of image stitching encompass:

**Keypoint Detection**: Identification of distinctive features within images.

**Descriptors:** Numerical representations assigned to keypoints for efficient matching.

**Feature Matching:** Establishing correspondence between keypoints across multiple images.

**Homograph:** A transformation matrix describing the geometric relationship between images.

**RANSAC**: Robust algorithm for estimating the homography matrix.

Image Warping: Transformation of images based on the calculated homography.

**Blending:** Seamless merging of images to produce a coherent composite.

A comprehensive understanding of these fundamental ideas and techniques is imperative for successful image stitching. Subsequent sections will delve deeply into each stage, providing real-world examples and OpenCV code samples. By following this pipeline and adhering to proper procedures, you can master the art of image stitching, producing captivating panoramic photographs.

**Lab Task**

Implement an image stitching pipeline to create a panorama from two or three images, which you can download from the internet. Justify and explain the choice of libraries and algorithms at each stage of the image stitching pipeline. Compare panoramas created as a result of choosing different feature detection algorithms.