**Conditions for stitching:**

1. All images are normalized with respect to size and perspective.
2. Sufficient Overlap
3. Lighting Consistency
4. Consistent Scene

**How does Image stitching work:**

The key concepts and techniques involved in image stitching include:

***Key point detection****:*

Identifying distinctive features in images.  
*Descriptors:* Representing key points with numerical descriptors for matching.  
*Feature matching:* Finding correspondences between key points across images.

***Homography****:* The transformation matrix that describes the geometric relationship between images.

***RANSAC****:* An algorithm for estimating the homographs matrix robustly.  
*Image warping:* Transforming images based on the estimated homograph.  
*Blending:* Merging images smoothly to create a seamless composite.

**Feature Detection and Extraction:**

Feature extraction and detection is the first and most important stage in the image stitching pipeline. This stage entails locating different key points in each image and calculating their descriptions. Descriptors give numerical representations of these key points for matching across multiple photos, while key points reflect distinctive features or points of interest in the image. We may use OpenCV’s several feature detection techniques, including SIFT, SURF, and ORB, to extract key points and descriptors from images.

***Feature Detection:***

* The goal of feature identification algorithms is to locate intriguing and recognizable focal areas in an image.
* These key points could stand in for locations with substantial texture differences, corners, or edges.
* To detect features, algorithms such as SIFT (Scale-Invariant Feature Transform), SURF (Speeded-Up Robust Features), and ORB (Oriented FAST and Rotated BRIEF) are frequently employed.
* These algorithms consider the key points’ scale and orientation to make them resistant to changes in scale and rotation.

***Feature Extraction:***

* The local picture data surrounding each key point is computed using the key point descriptors that have been identified.
* The key points’ surrounding patches are numerically represented as descriptors, which encode their look or texture.
* Descriptors include details on the neighborhood’s texture, color, and gradient characteristics.
* Feature descriptor extraction techniques are also included in the SIFT, SURF, and ORB algorithms.

***Feature matching:***

A crucial stage in image stitching is feature matching, which creates correspondence between key points in various images. To ensure accurate alignment and registration of the images, it seeks to identify key points that match based on their descriptors. Numerous features matching methods, including FLANN (Fast Library for Approximate Nearest Neighbors) based matching and brute-force matching, are offered by OpenCV, each with unique properties and benefits.

***Warping and Blending:***

The following steps entail warping the images depending on the homography and combining them to generate a seamless composite image after estimating the homography matrix in the previous step. The stitched photos will be properly aligned and have seamless transitions between them thanks to this procedure.