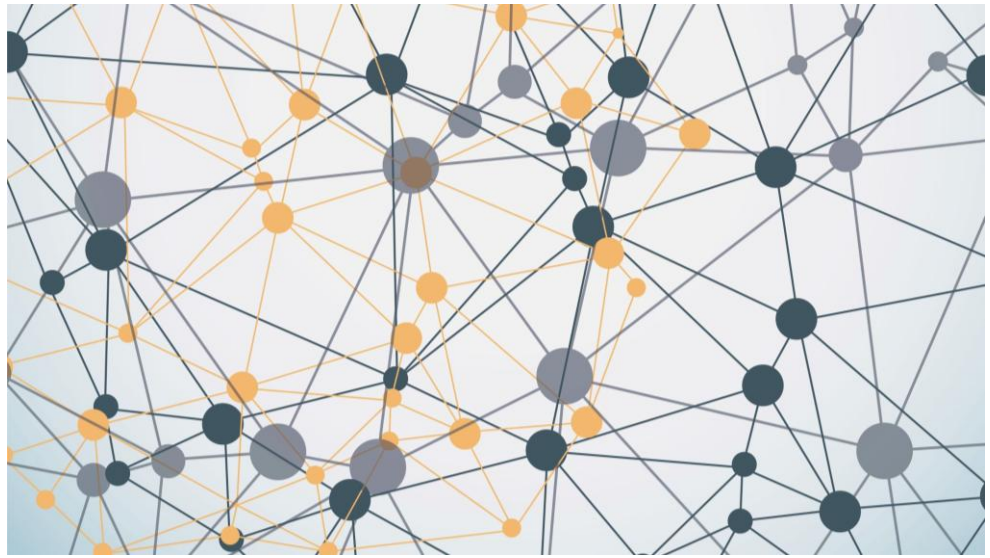
Line fitting

Least square fit & RANSAC



Line fitting

Least Squares fit (over constraint)

RANSAC (constraint)

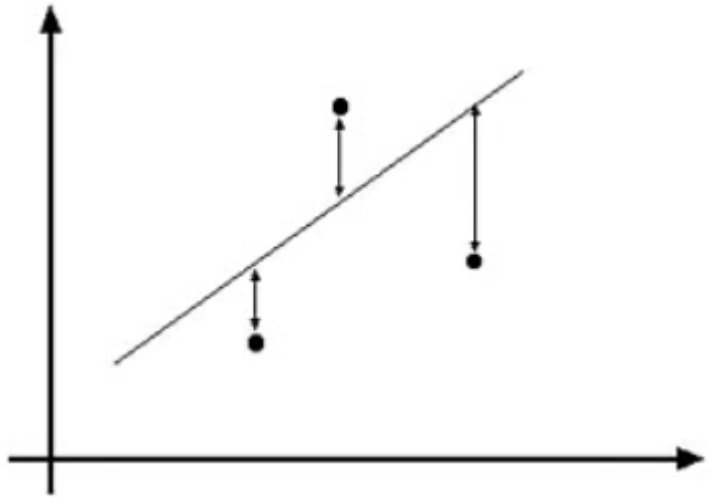
Hough Transform (under constraint)

Least Squares fit

$y = mx + c = f(x, m, c)$

$$\text{Minimize } E = \sum_i [y_i - f(x_i, m, c)]^2$$

Take derivatives wrt m & c and set them to zero



Least Squares fit || pseudo inverse

$$y = mx + c$$

$$y_1 = mx_1 + c$$
$$y_2 = mx_2 + c$$
$$\vdots$$
$$y_n = mx_n + c$$

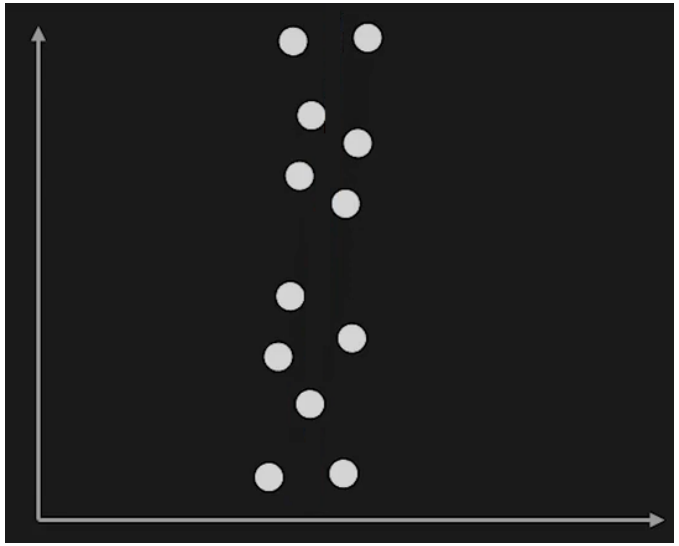
$$\underbrace{\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}}_{B} = \underbrace{\begin{bmatrix} x_1 & 1 \\ x_2 & 1 \\ \vdots & 1 \\ x_n & 1 \end{bmatrix}}_{A} \underbrace{\begin{bmatrix} m \\ c \end{bmatrix}}_{D} \Rightarrow B = AD$$

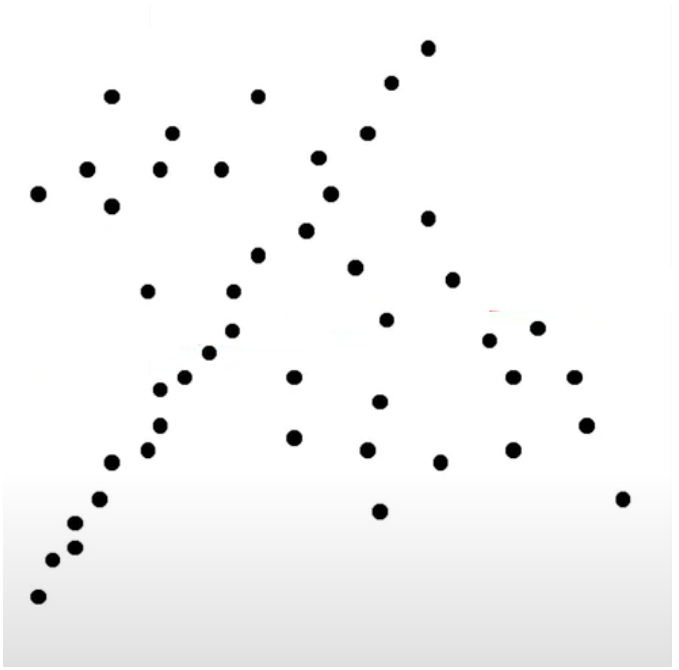
$$A^T B = A^T AD$$
$$\left(A^T A\right)^{-1} A^T B = \left(A^T A\right)^{-1}\left(A^T A\right)D$$
$$D = \left(A^T A\right)^{-1} A^T B$$

Challenges

Vertical line

Multiple lines

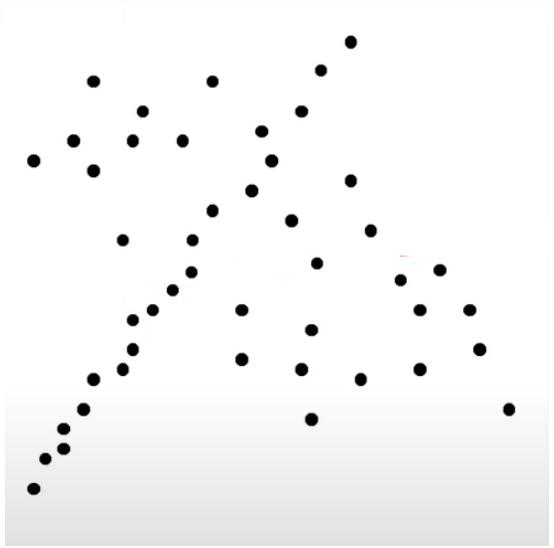




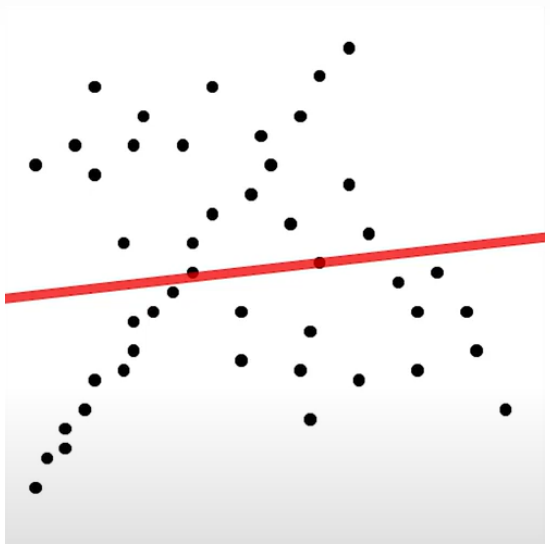
RANSAC: Random Sample Consensus

1. Randomly select two points to fit a line
2. Find the error between the estimated solution and all other points. If the error is less than tolerance, then quit, else go to step 1.

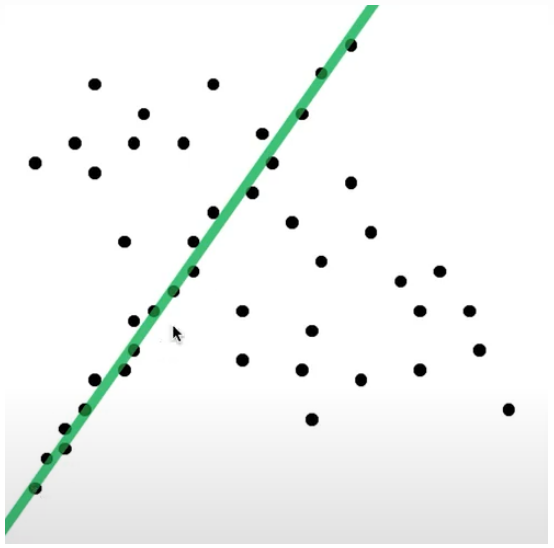
Comparison



Edge image



Least Squares fit



RANSAC

Image Stitching (Panorama)

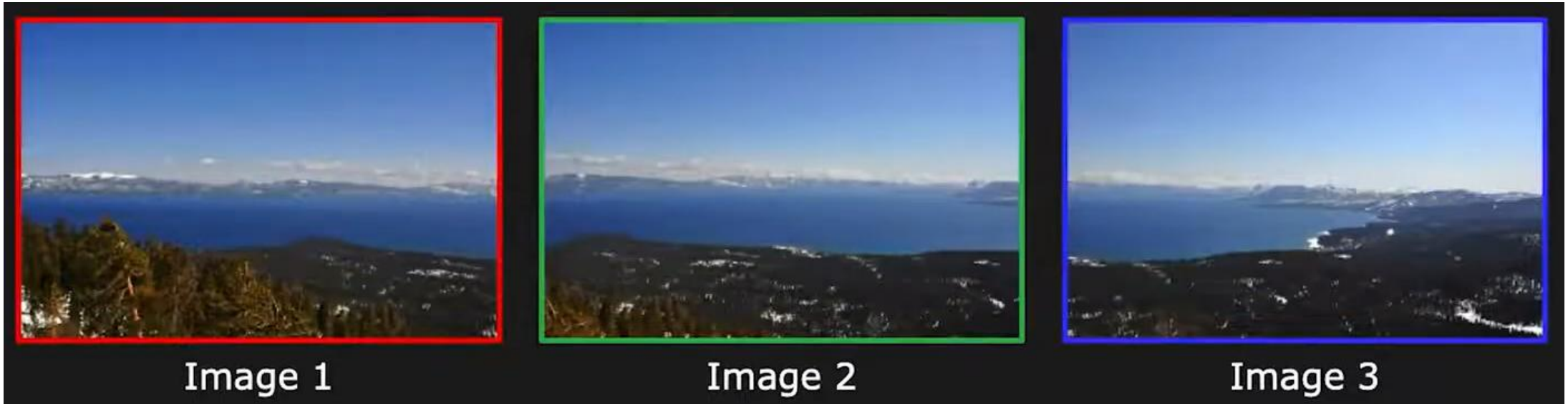


Image Stitching: SIFT detector

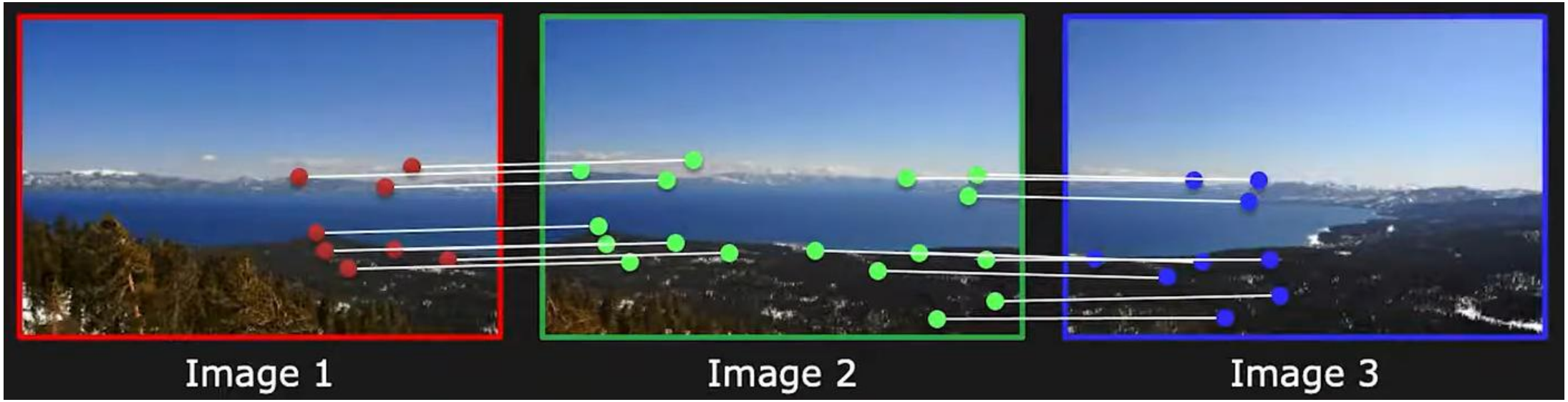


Image Stitching: Geometric relationship

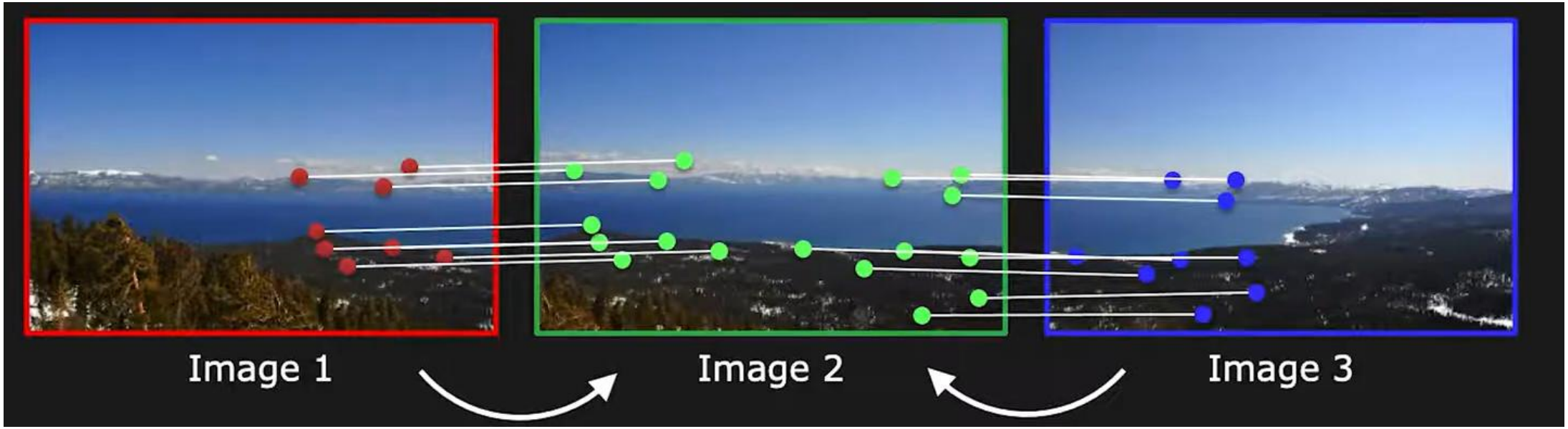


Image Stitching: Warping

Image Stitching

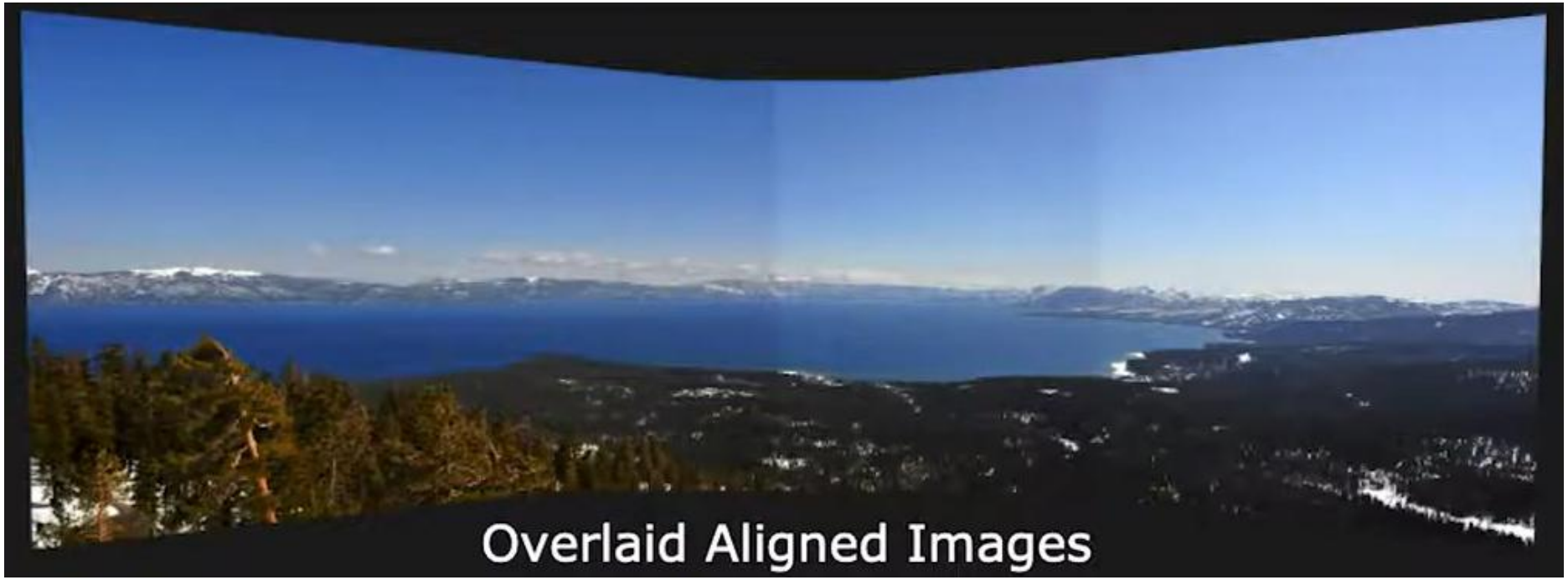


Image Stitching: Blending

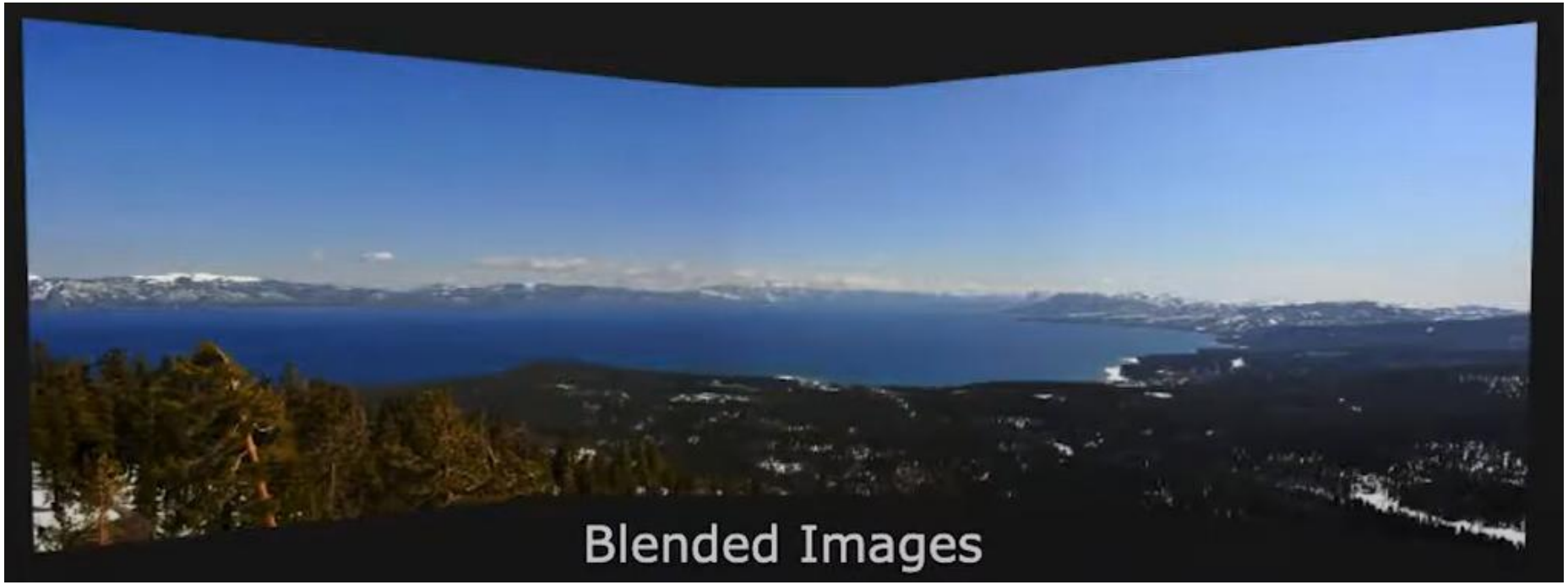


Image Stitching

1. Perform Transformations (Projective)
2. Computing Homography
3. Dealing with Outliers (RANSAC)
4. Warping and Blending images