

# Finding Common Features in Satellite Images with AI

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## Objectives

- Evaluate the SIFT, ORB, and CNN methods to find common features in the ABI lunar image
- Identify the optimal method for the ABI lunar feature extraction and the phase angle ranges
- Register the ABI lunar images to the reference image

## Results

- Three feature recognition methods, SIFT, ORB, and CNN, are explored to detect and match distinct keypoints of images.
- Three methods, RANSAC, LMEDS, and RHO, are tested to remove inaccurate matches from dataset to generate a dataset with best fitting matches
- RANSAC algorithm tends to produce the highest quality registration compared to the LMEDS and RHO algorithms. RANSAC algorithm produces registered images with the lowest error percentage according to the Mean Squared Error (MSE) and Normalized Mean Squared Error (NMSE).
- The best underlying algorithm for the RANSAC algorithm was SIFT and CNN.
- Working to improve the image registration accuracy with combined SIFT and CNN methods

**Image Registration Error between Reference image (~5°) and Target image (60°) (lower is better)**

	SIFT		ORB		CNN		SIFT+CNN	
	MSE	NMSE	MSE	NMSE	MSE	NMSE	MSE	NMSE
RANSAC	28.48%	0.046%	28.80%	0.047%	28.39%	0.046%	28.33%	0.046%
LMEDS	28.59%	0.047%	97.76%	0.159%	28.42%	0.046%	-	-
Randomized Hough Transform	28.75%	0.046%	28.87%	0.047%	28.52%	0.047%	-	-



Figure 1: Reference ABI Lunar Image (~5°)

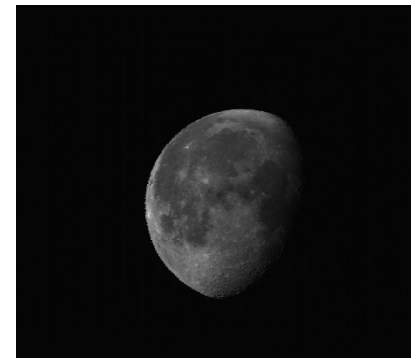


Figure 2: Target ABI Lunar Image (60°)



Figure 3: Registered ABI Lunar Image using CNN+SIFT (60°)



Figure 4: RGB channel image of reference & registered moon (blue/green = reference, red = registered)