

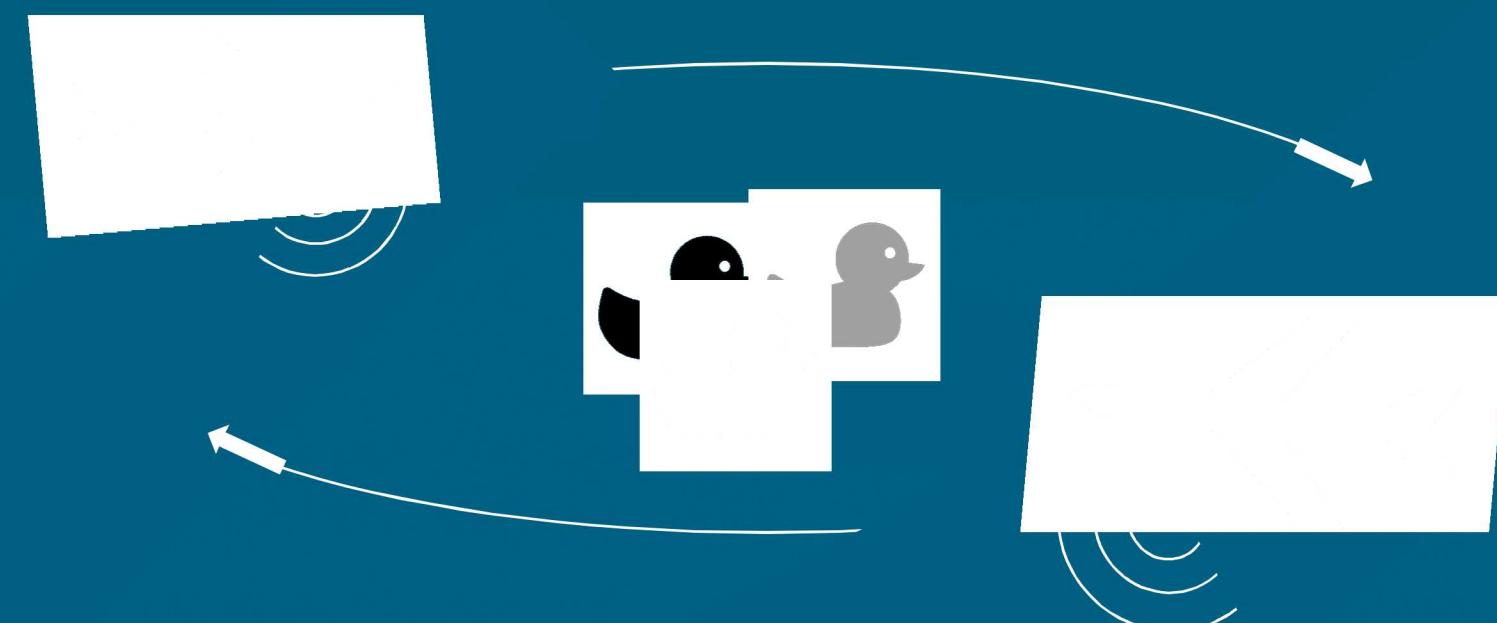


# SAR Image Alignment

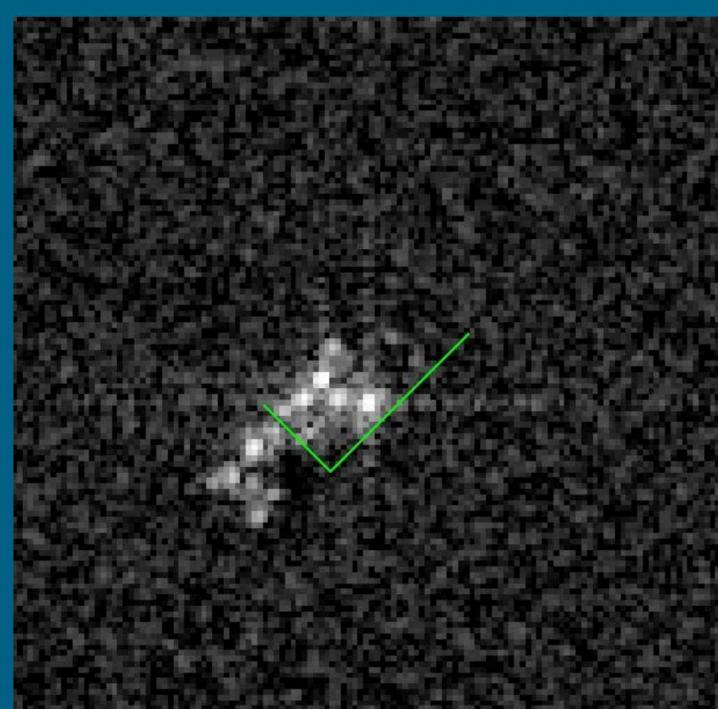
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SAND2019-8017D

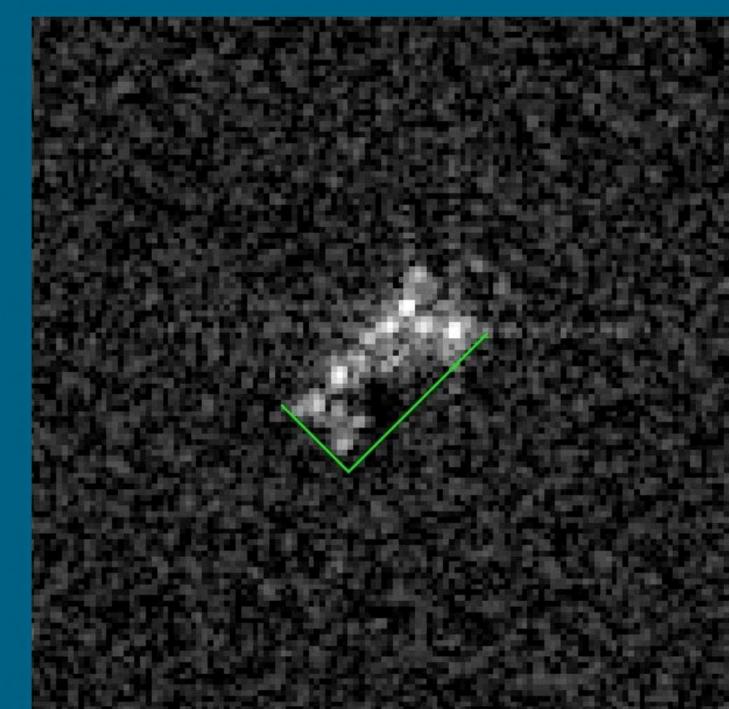
Project Mentor: Colton Snell, Org. 05448



## Task



Simulated imagery can be misaligned due to user error, but we need aligned images in order to characterize objects



How do we get them aligned from a misaligned starting point?

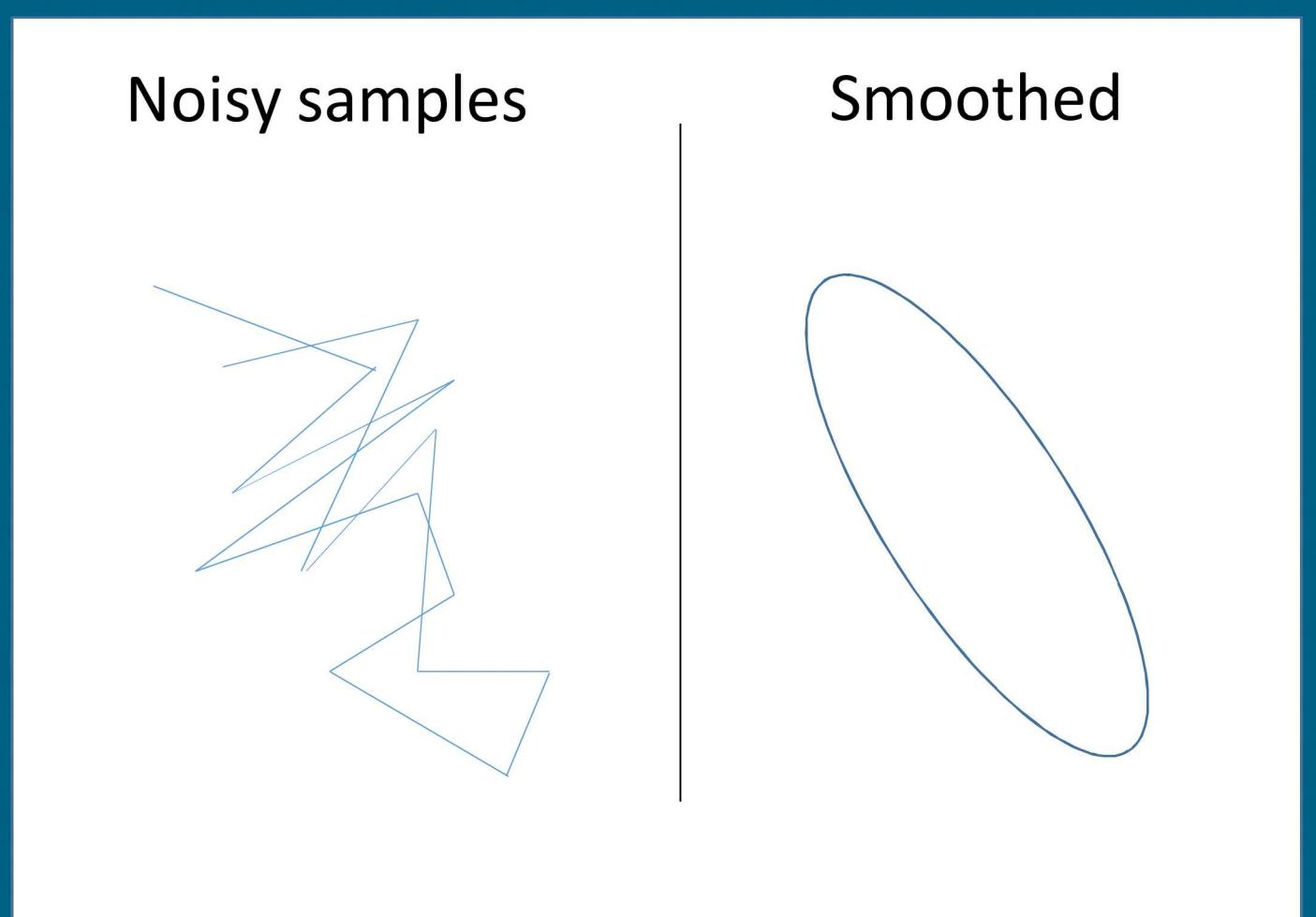
## An Unsupervised Approach

$$E_{ij}(\mathbf{s}) = I(\mathbf{s}^{ij}) + \lambda_\phi \left( \mathbf{s}^{ij} - \frac{\mathbf{s}^{i-1,j} + \mathbf{s}^{i+1,j}}{2} \right)^2 + \lambda_\theta \left( \mathbf{s}^{ij} - \frac{\mathbf{s}^{i,j-1} + \mathbf{s}^{i,j+1}}{2} \right)^2$$
$$E(\mathbf{s}) = \sum_{i,j} E_{ij}(\mathbf{s})$$

Use an energy function to specify what “good” object center estimates look like

Take into account images taken from similar perspectives to keep the trajectory smooth

## Optimizing the Energy



- Draw samples from the distribution defined by the energy function with Gibbs sampling
- Average the samples and smooth the trajectory with a Gaussian filter to obtain a full misalignment estimate

## Future Work

Use the fact that misalignment will always manifest as a circular procession of the object in order to optimize over fewer parameters and eliminate the need for smoothing