# Video Reconstruction from Randomized Video Frames

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## Motivation

In some scientific experiments there is a need to extract dynamic information from a series of static images. For example, at the SLAC National Accelerator Laboratory, proteins can be imaged at different conformations but the samples are destroyed in the process. In order to reconstruct the transformations between conformations, an algorithm needs to be designed that essentially orders the randomized frames in the most likely temporal sequence.

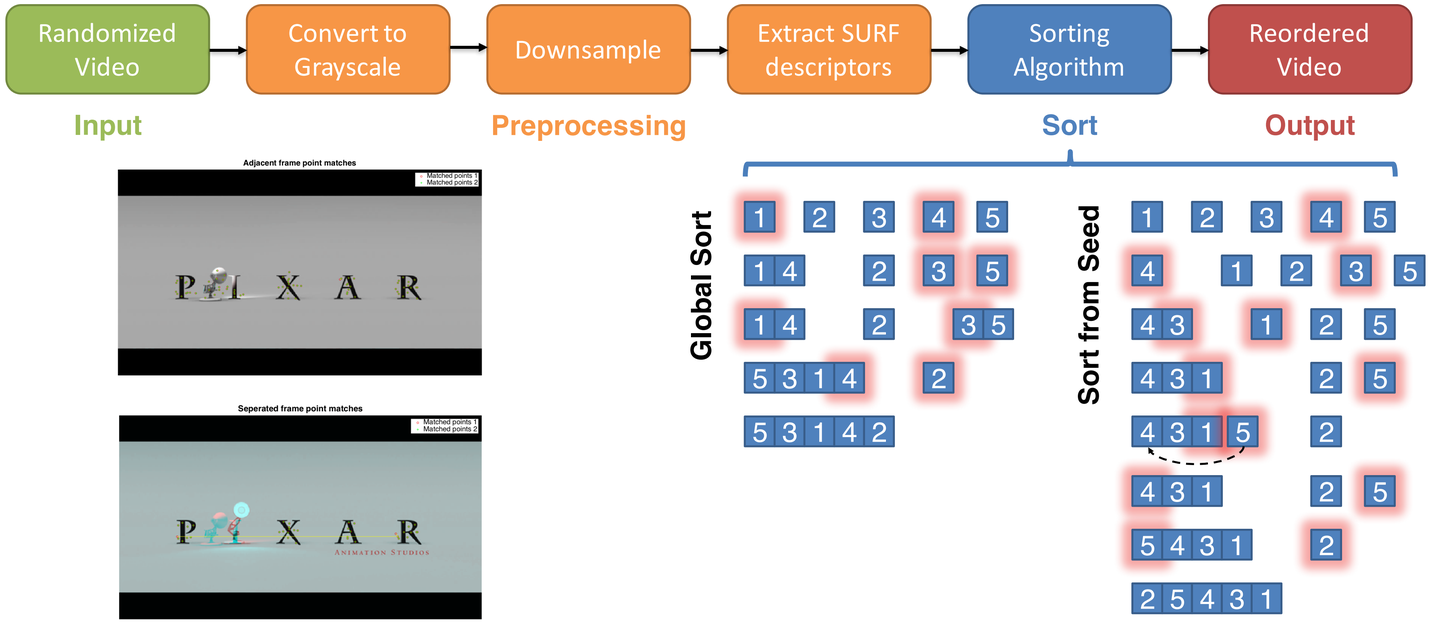
To start tackling this problem, this project focuses on the reordering of a randomized 2D video. The goal is to develop techniques that can be generalized to the 3D case and evaluate the effectiveness of using feature matching to order video frames.

## Future Work

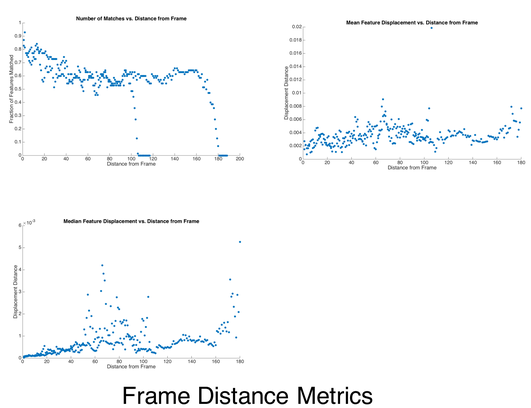
The algorithm performed well when reconstructing shuffled 2D videos. The global sort performed the best and was the most robust to downscaling and skipping frames. However the algorithm would need to be improved to be more robust to distortions before being applied to reconstructing experimentally collected data which is subject to distortions like rotations and noise. Specifically the algorithm could be improved in the following ways:

- Improve the algorithm when the frames are rotated
- Optimize the sorting algorithm (global sort scales as $O(N^2)$)
- Derive a more accurate distance metric between frames
- Experiment with matching directly from diffraction patterns
- Generalize to 3D sequences

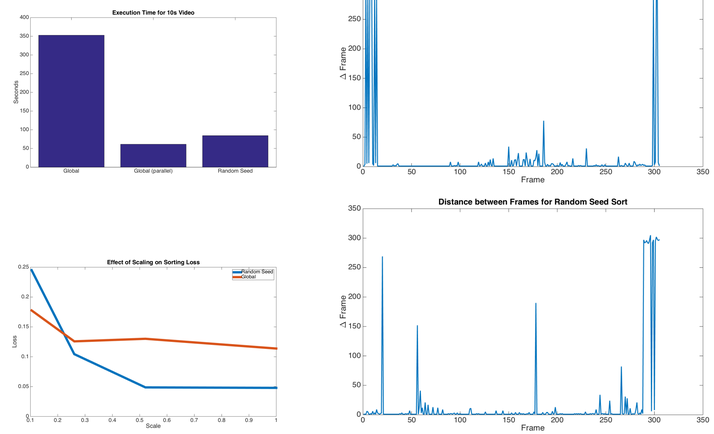
## Video Reconstruction




## Analysis




Frame Distance Metrics




Performance