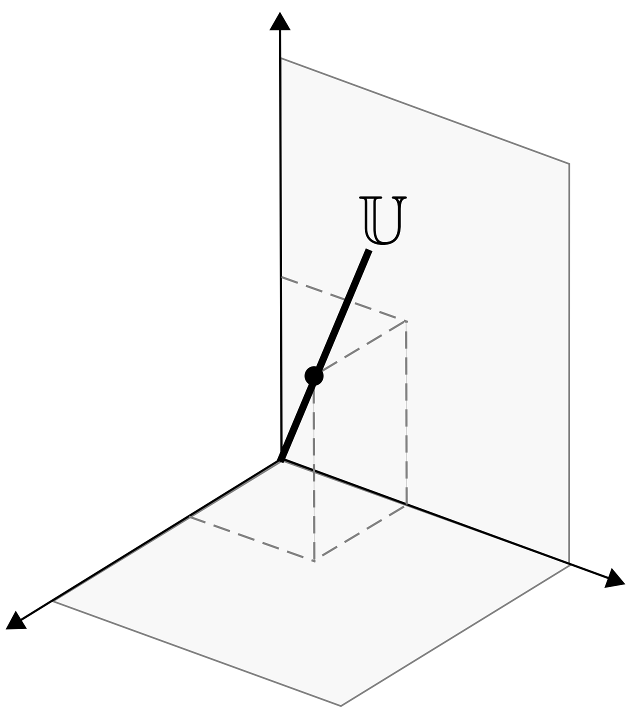
Karan Srivastava
The person you're looking at

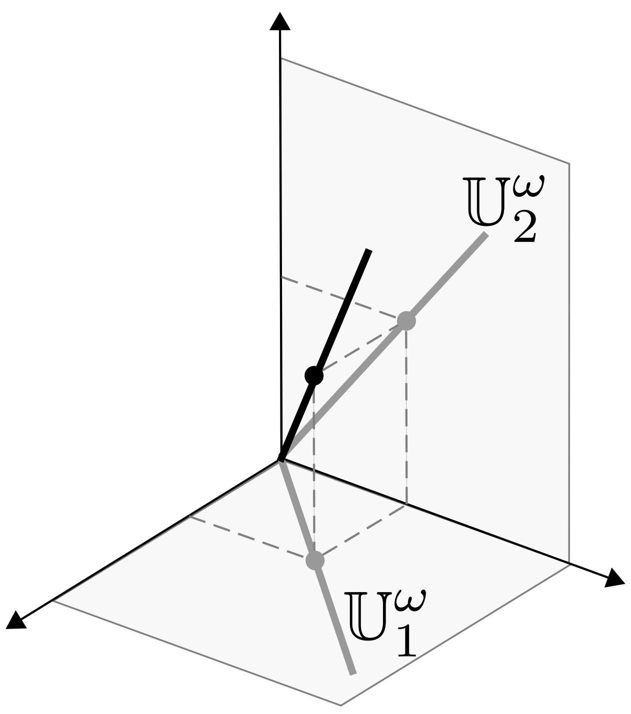
Daniel Pimentel-Alarcón
Not the person you're looking at

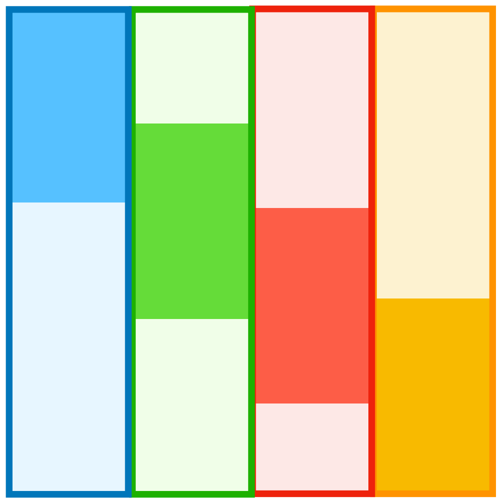
Subspace Reconstruction

Problem Description



Problem Description





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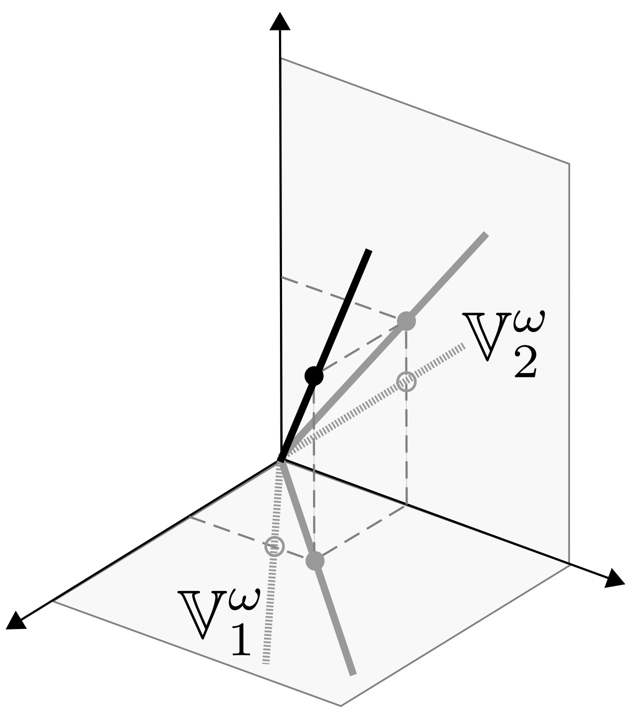

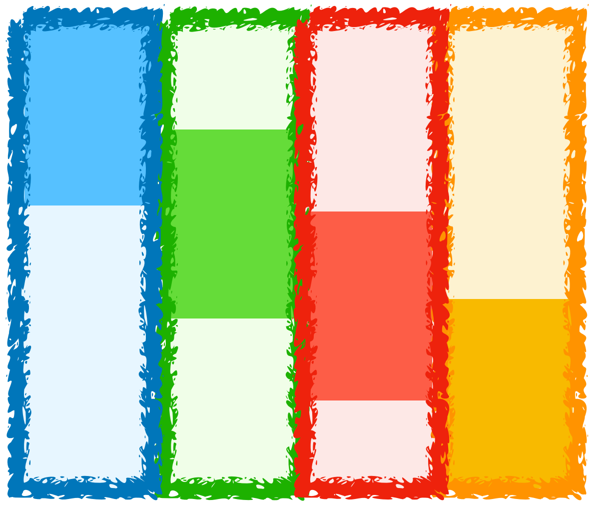

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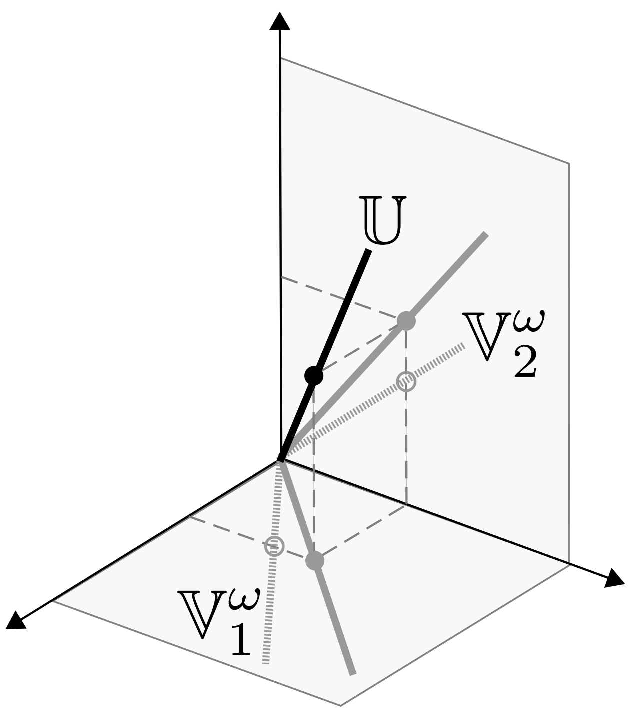
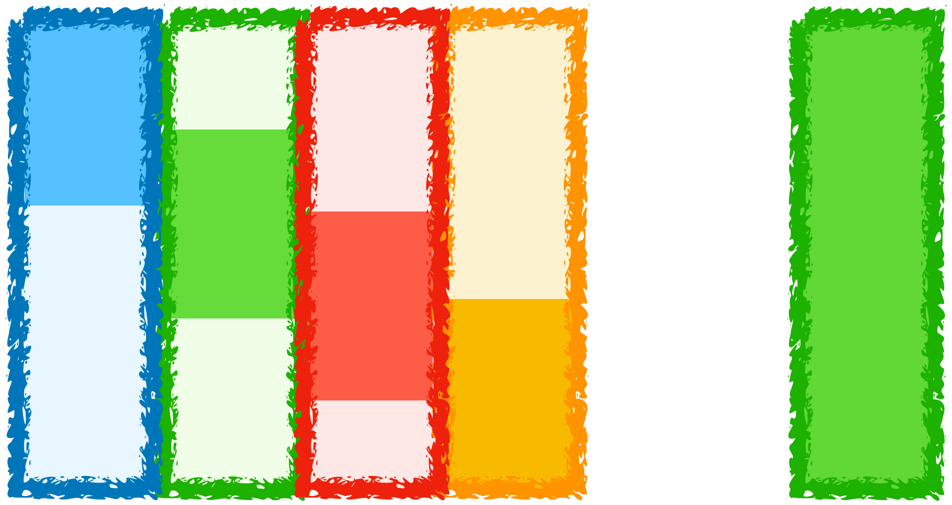
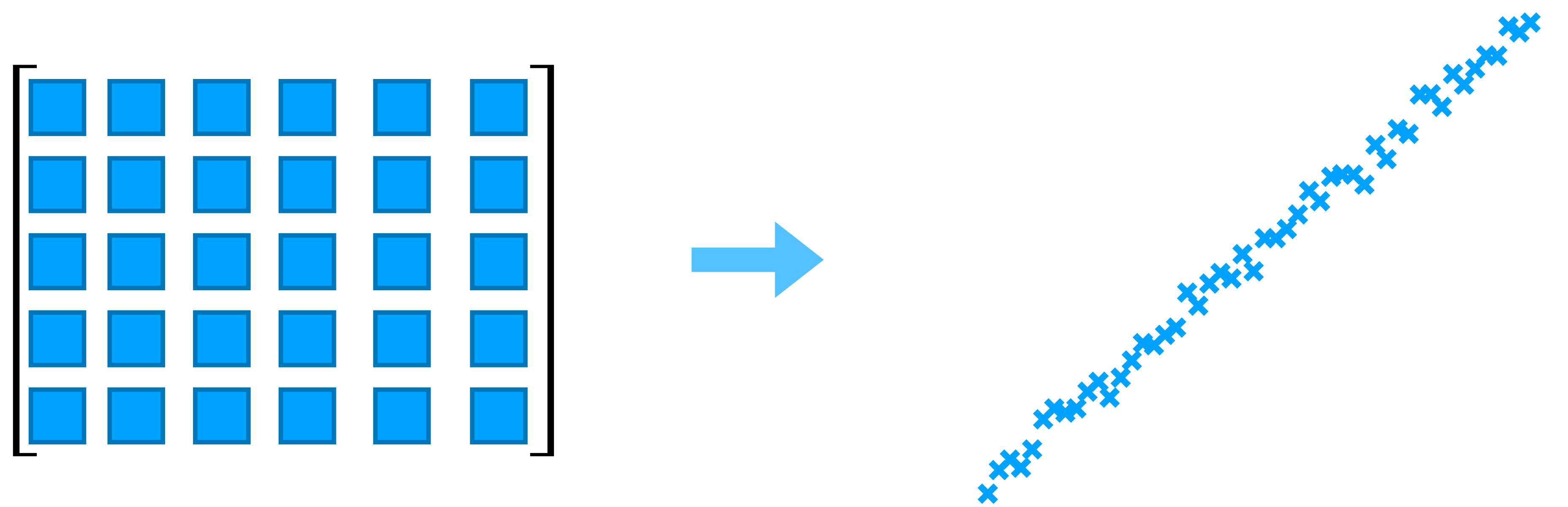




Goal: To estimate the line (or linear shape) from the noisy pieces and bound the error?

Motivation

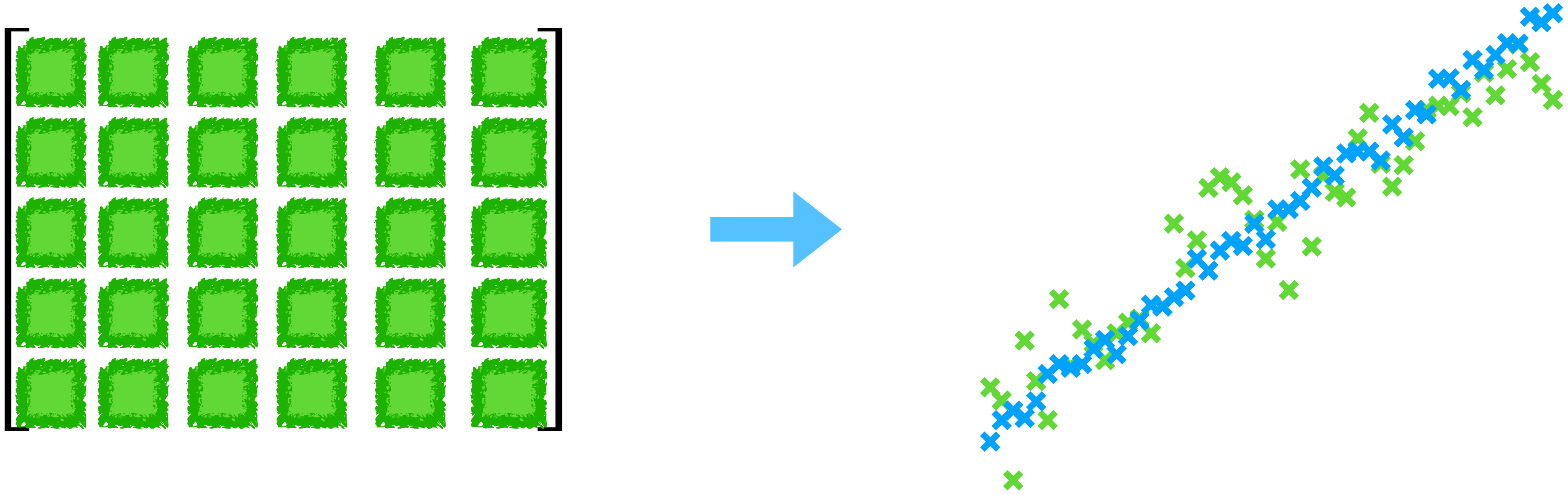
Our main tool for modelling data is linear algebra



Since data is often best modelled by subspaces

Motivation

Our main tool for modelling data is linear algebra

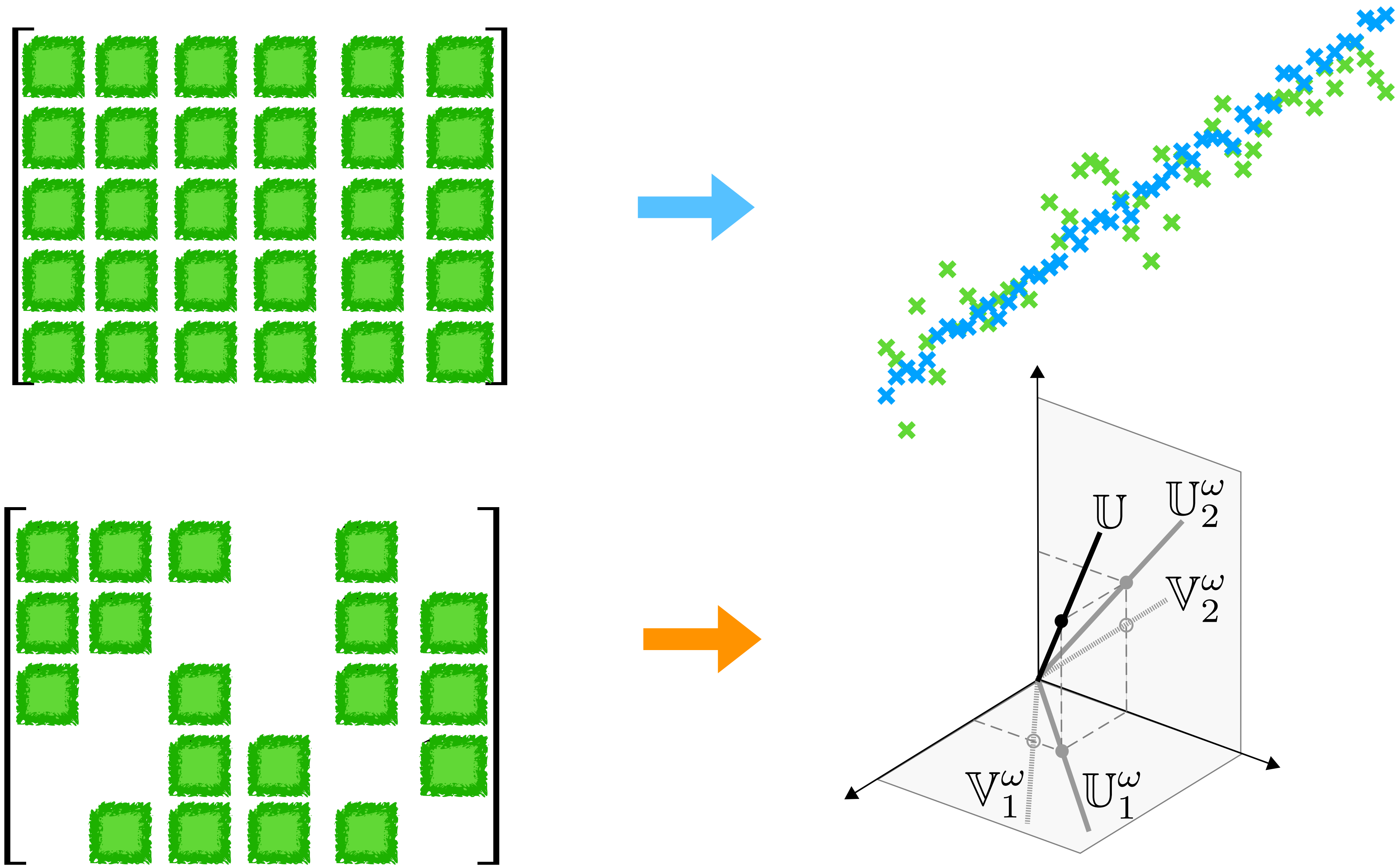


Since data is often best modelled by subspaces

But data is often noisy

Motivation

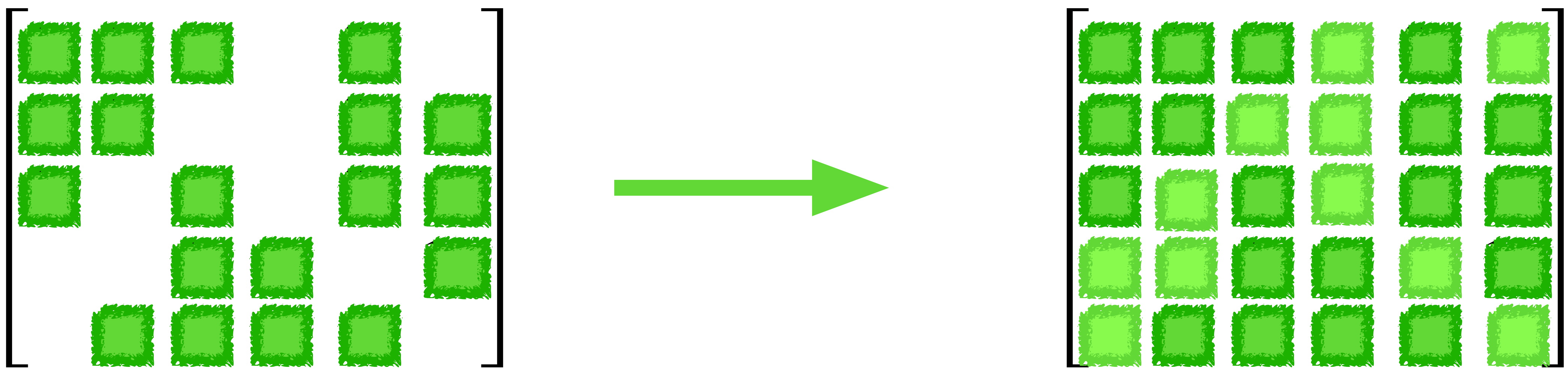
Our main tool for modelling data is linear algebra



Since data is often best modelled by subspaces

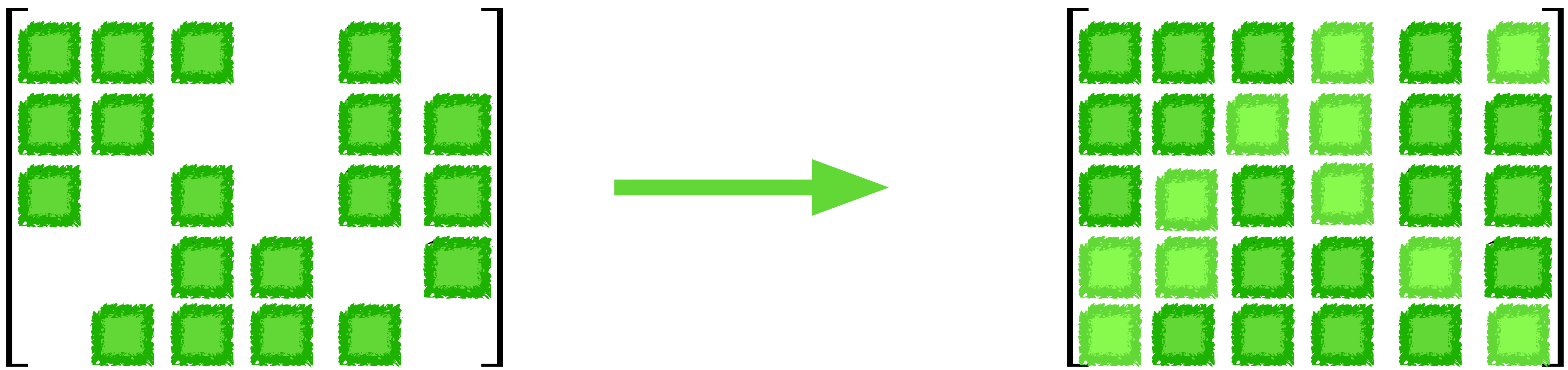
But data is often noisy and missing

Motivation

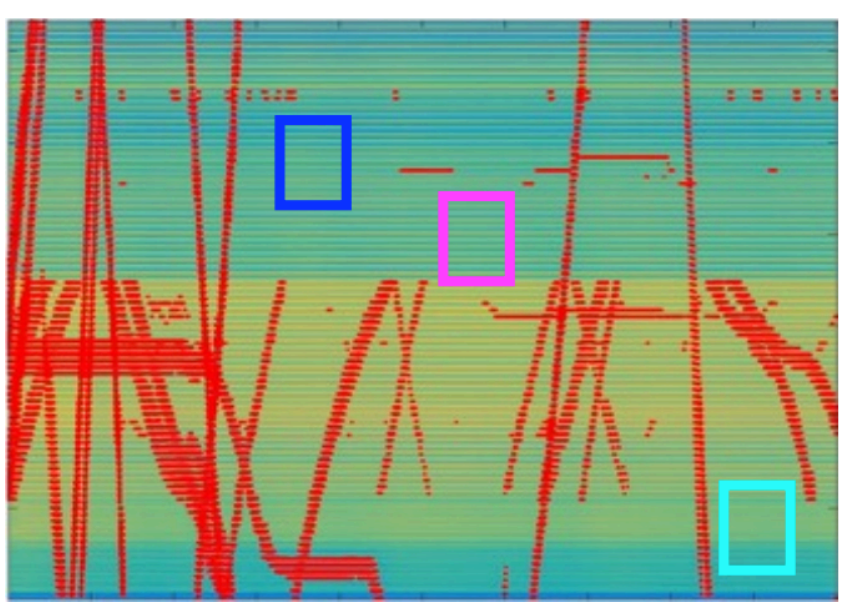


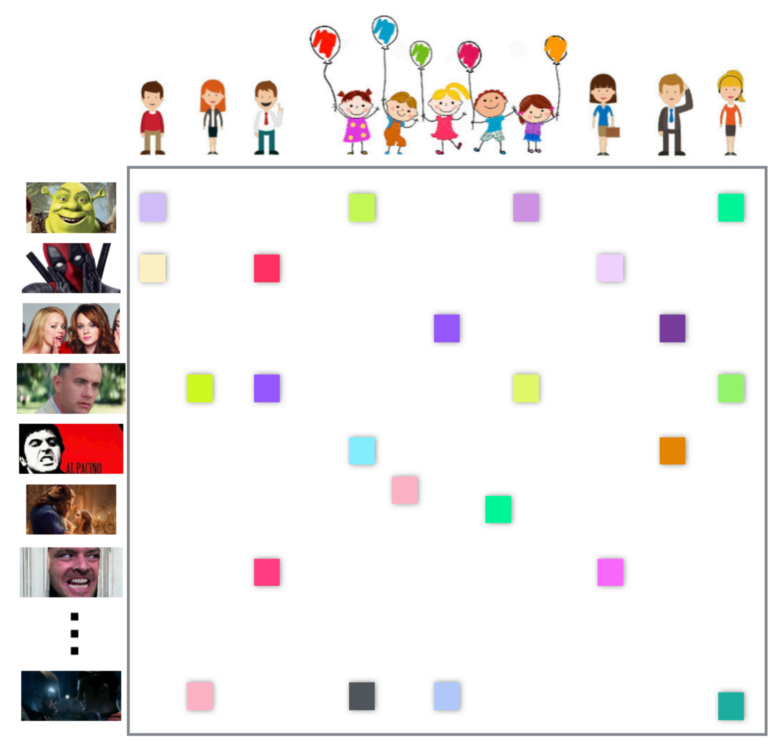
The problem of completing matrices is
Matrix Completion

Motivation

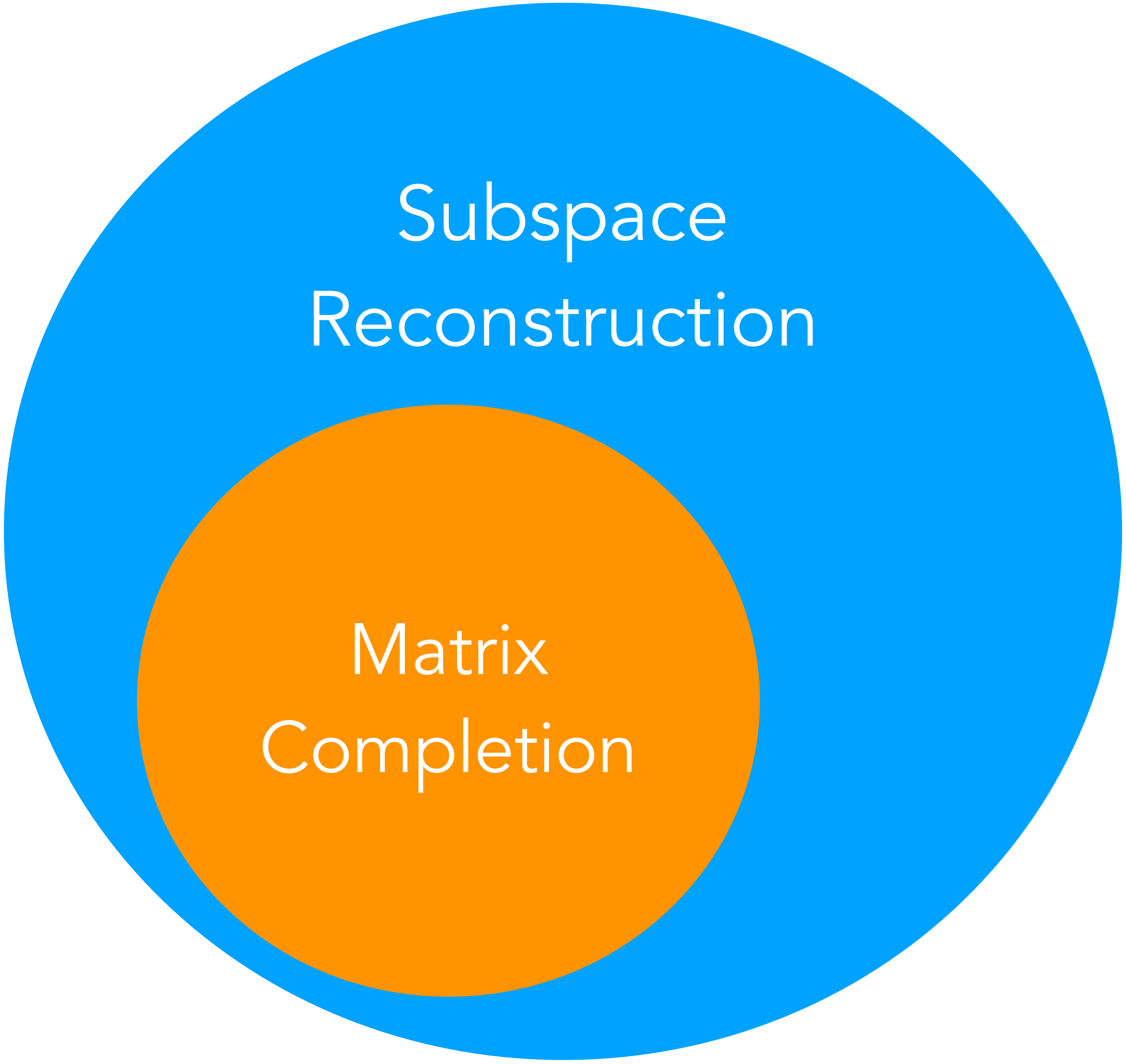


The problem of completing matrices is
Matrix Completion

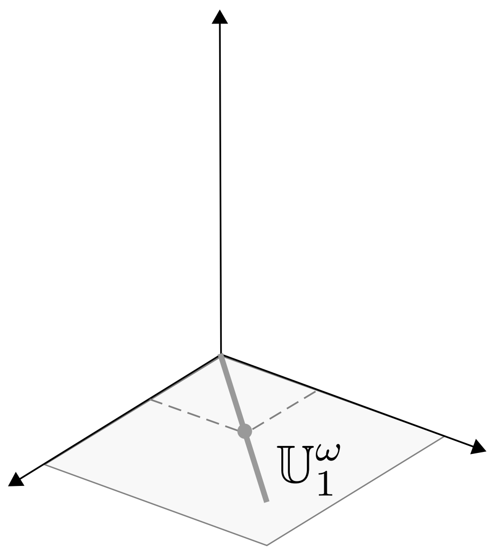


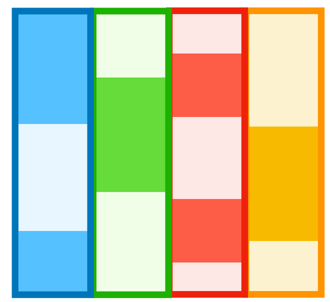


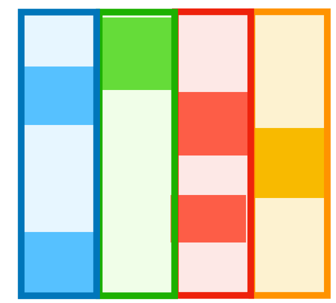
Motivation

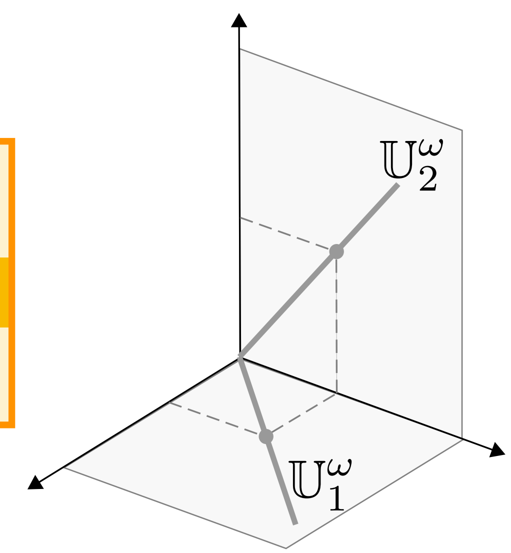


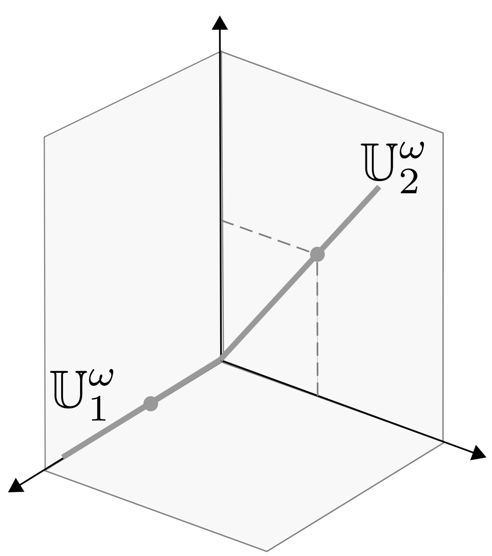
Previous Work - Noiseless Case

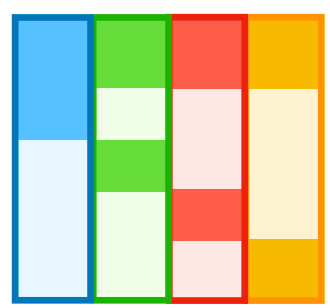












Question: Which projections do we need to observe for a unique reconstruction?

D. L. Pimentel-Alarcón, N. Boston, and R. D. Nowak, "Deterministic conditions for subspace identifiability from incomplete sampling," in *Information Theory (ISIT), 2015 IEEE International Symposium on*. IEEE, 2015, pp. 2191–2195.

Our Work - Noisy Case

Theorem (S., P.-A.)

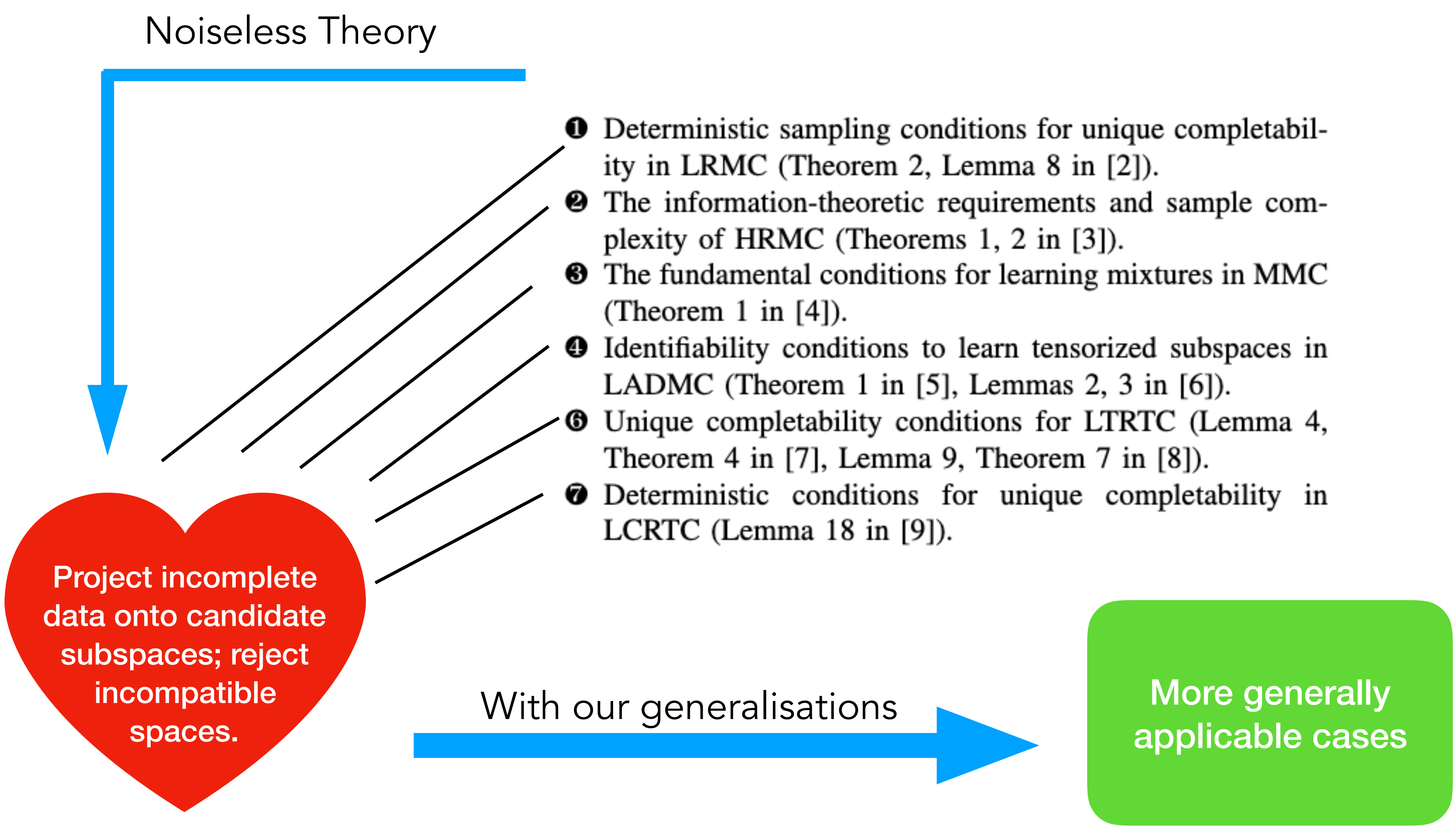
For almost every $\mathbb{U}$,

$$d_G(\mathbb{U}, \hat{\mathbb{U}}) \leq \frac{\epsilon\sqrt{2r(d-r)}}{\delta \cdot \sigma(B)}$$

Measure of how good the guess is

The cool bound we found

Applications - LRMC Theory



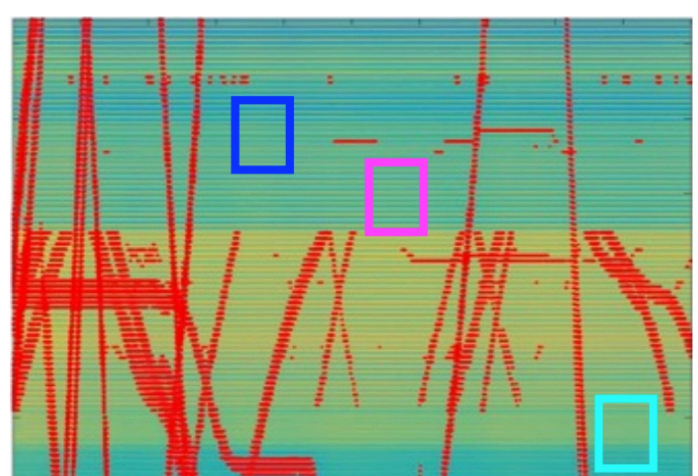
Applications - RPCA

Original Frame

Subspace Reconstruction Based Background Segmentation

RPCA-ALM
(Lin et.al 2011-206)

D. Pimentel-Alarcón and R. Nowak, “Random consensus robust pca,” *Electronic Journal of Statistics*, vol. 11, no. 2, pp. 5232–5253, 2017.



Future Directions

- Line -> Curved Shapes - Can we do this in a computationally feasible way?
- How to find these projections - Can we find an algorithm to find projections given sparse data?
- Can we generalize these bounds to cases where we have multiple subspaces?

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