**Introduction**

- acquisition challenges
- need fully sampled data
- regularization & interpolation
- exploit low-rank structure of seismic data

**Quantifying regularization error**

Let $X_r \in \mathbb{C}^{n \times m}$, $b = R(M(X_r)) + \epsilon$ with $\|\epsilon\| \leq \eta$, and $\|N(X_r) - X_{ir}\|_F \leq \epsilon$. Let $\hat{X}$ be the solution of BPDN$_{1+\sigma}$, then

$$\|X_r - \hat{X}\|_F \leq \frac{C_1}{\sqrt{k}} \sum_{i=1}^{k+1} \sigma_i(X_r) + C_2 \sigma + C_2 \eta$$

where $l = \min\{n, m\}$

**Regularization & Interpolation**

**Figure 2:** Regularization and interpolation. Ground truth at (a) irregular grid, (b) and with missing traces. (c, d) Recovery and difference using proposed rank-minimization on unstructured grids with a SNR of 19.3 dB.

**Conclusion**

- Binning does not preserve the underlying low-rank structure of seismic data
- Incorporation of grid-irregularity in matrix-completion benefits the regularization & interpolation process and preserve the low-rank structure of seismic data
- Propose matrix-completion framework is computationally affordable for large-scale problems since its SVD-free

**References**

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**Figure 1:** Impact of regularization on singular values decay in the transform-domain. Monochromatic frequency slice at 35 Hz in the midpoint-offset domain. (a) ground truth, (b) binning using nearest-neighbor interpolation, (c) unstructured sampling operator based rank-minimization, (d) singular values decay in the midpoint-offset domain.