# Journal Watch
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- Setup: Mixture of sparse linear regressions model
  - Unknown sparse vectors $\beta^1, \ldots, \beta^L$ of length $n$, with a total of $k$ non zeros
  - Observe $m$ linear measurements

    $$y_i = x_i^\top \beta^{l_i} + w_i, \quad i \in [m]$$

    with label $l_i \in [L]$ unknown
    ($l_i$s chosen randomly according to a weight distribution)
  - Goal is to estimate $\beta^1, \ldots, \beta^L$
- Applications: speaker identification, background modeling

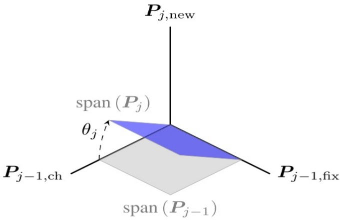
- When $L = 1$, this is the standard compressed sensing problem
- Contributions: An algorithm based on sparse graph codes; guarantees for $n, k \to \infty$ (under assumptions involving support overlap of $\beta$s)
  - Noiseless case: Sample and time complexity of $\Theta(k)$
  - Noisy case with $L = 2$: Sample complexity of $\Theta(k\text{polylog}(n))$

- Dynamic RPCA: track a slowly changing subspace in the presence of sparse outliers

- At time instant $t$, observe $y_t \in \mathbb{R}^n$ where

$$y_t = l_t + x_t + v_t, \quad t = 1, \ldots, d.$$

$l_t$: true data lying in a slowly changing subspace of $\mathbb{R}^n$
$x_t$: sparse outlier
$v_t$: bounded noise




- Contributions
  - A recursive projected CS algorithm for subspace tracking that works under weaker assumptions on subspace change rate and outlier magnitude
    Assuming previous subspace estimate $\hat{P}_{t-1}$ is available, compute

$$\tilde{y}_t = \Psi x_t + b_t$$

    where $\Psi = I - \hat{P}_{t-1}\hat{P}_{t-1}^\top$ and $b_t = \Psi(l_t + v_t)$, and use CS
  - Improved outlier tolerance compared to previous RPCA algorithms

- Problem: Analysis of Restricted Isometry Constant (RIC) of Gaussian matrices
- Bounds on maximum sparsity level for CS algorithms usually obtained using
  - RIP based analysis
  - Coherence based analysis
  - Geometric methods

- Calculating the RIC is intractable; can be shown to be bounded for certain random designs
- RIP analysis usually done using concentration of measure arguments, this may be loose in some settings
- Contributions
  - New approach to deriving RIC based on distribution of extreme eigenvalues of Wishart matrices
  - Bound on maximum sparsity allowed for recovery algorithms like $\ell_1$ minimization to guarantee a target reconstruction probability

# Other interesting papers

- A Data-Dependent Weighted LASSO Under Poisson Noise. *X. J. Hunt, P. Reynaud-Bouret, V. Rivoirard, L. Sansonnet and R. Willett*
- Sharp Oracle Inequalities for Stationary Points of Nonconvex Penalized M-Estimators. *A. Elsener and S. van de Geer*
- Estimation of a Density From an Imperfect Simulation Model. *M. Kohler and A. Krzyzak*
- Quickest Change Detection Under Transient Dynamics: Theory and Asymptotic Analysis *S. Zou, G. Fellouris and V. V. Veeravalli*