Regularization in Directable Environments with Application to Tetris

Jan Malte Lichtenberg
Özgür Şimşek
Shrinkage Toward Equal Weights (STEW)

$$
\mathcal{L}^{STEW}(\beta, \lambda) = \|y - X\beta\|_2^2 + \lambda \sum_{i < j} |\beta_i - \beta_j|^q
$$

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Equal Weights

Weight estimates

\[ \lambda \text{ (log scale)} \]

STEW (q = 2)

Weight estimates

\[ \lambda \text{ (log scale)} \]

Ridge regression: \( \lambda \sum_i \beta_i^2 \)

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"1 / N rule" (DeMiguel et al., 2009)
\[ \mathcal{L}(\beta, \lambda) = \|y - X\beta\|_2^2 + \lambda \sum_{i<j} |\beta_i| - |\beta_j| \|^q \]
\[ \mathcal{L}(\beta, \lambda) = \| y - X\beta \|_2^2 + \lambda \sum_{i<j} | \beta_i | - | \beta_j | |^q \]

Are **feature directions** known?
\[ \mathcal{L}(\beta, \lambda) = \|y - X\beta\|^2_2 + \lambda \sum_{i<j} |\beta_i - \beta_j|^q \]

Are **feature directions** known?

"Direct" all features

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$$\mathcal{L}(\beta, \lambda) = \| y - X\beta \|^2 + \lambda \sum_{i<j} |\beta_i - \beta_j|^q$$

Are **feature directions** known?

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$$\mathcal{L}^{STEW}(\beta, \lambda) = \| y - X\beta \|^2 + \lambda \sum_{i<j} |\beta_i - \beta_j|^q$$
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\mathcal{L}(\beta, \lambda) = \|y - X\beta\|_2^2 + \lambda \sum_{i<j} |\beta_i - \beta_j|^q
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Are **feature directions** known?

↓

"Direct" all features

↓

\[
\mathcal{L}^{STEW}(\beta, \lambda) = \|y - X\beta\|_2^2 + \lambda \sum_{i<j} |\beta_i - \beta_j|^q
\]

for \( q = 2 \), \( \arg\min_\beta \mathcal{L}^{STEW}(\beta, \lambda) = (X^T X + \lambda D^T D)^{-1} X^T y \)

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Tetris

Mean score vs. Iteration (log scale)

- M-learning + STEW
- M-learning + NN
- M-learning + Ridge
- M-learning
- Equal Weights

Poster #137 @ Pacific Ballroom

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