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A New Look at Adjusted Plus/Minus (APM) for Basketball Analysis

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APM Model:

$$Y = 1_n \beta^*_{hca} + X\beta^* + \epsilon$$

APM Algorithm:

$$(\hat{\beta}_{OLS}, \hat{\beta}_{hca}) = \arg\min \left\| Y - 1_n \beta_{hca} - X\beta \right\|_2^2$$

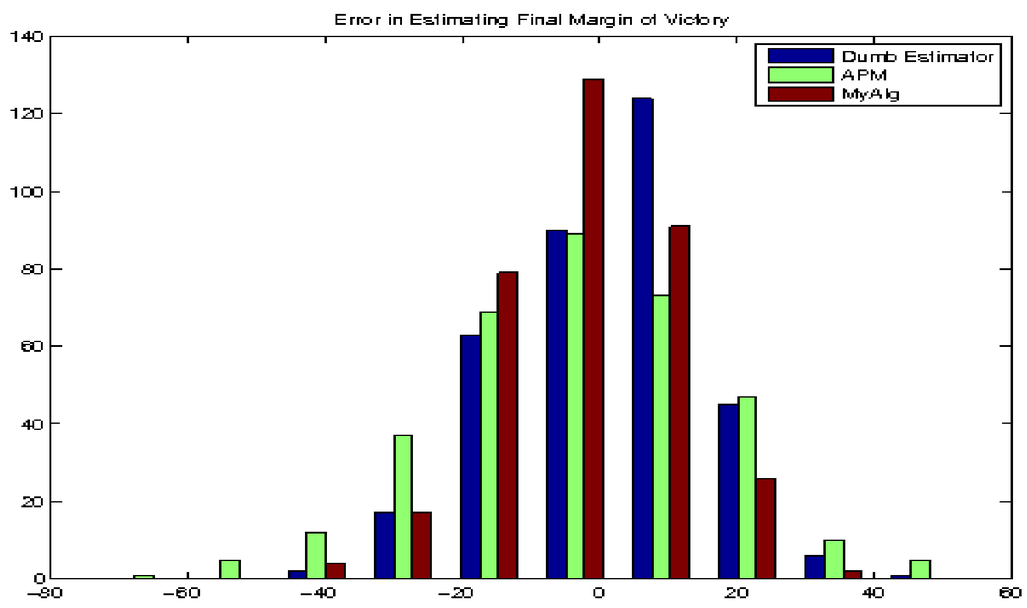
The lambda-PM Objective Function:

$$\begin{aligned} g(\beta_{hca}, \beta, z_0, z, \beta_{median}; \vec{\lambda}) = & \quad \|y - 1_n \beta_{hca} - x\beta\|_2^2 \\ + & \quad \lambda_1 \|\beta - \beta_{median}\|_1 \\ + & \quad \lambda_2 \|\beta - z_0 - Rz\|_2^2 + \lambda_3 \|z\|_1 + \lambda_4 \beta^T v v^T \beta \end{aligned}$$

The lambda-PM Convex Program:

$$\beta_{hca}, \beta, z_0, z, \beta_{median} = \arg\min g$$

We use cross-validation to select lambda. How does lambda-PM compare to HCA estimate and APM?



	HCA	APM	$\vec{\lambda}PM$
Fraction of Games Guessed Wrong	0.3793	0.3333	0.2874
Mean of Absolute Error	11.54	15.83	10.58
Variance of AE	70.38	149.02	65.07
Median of AE	9.50	13.88	9.10
Min of AE	0.3	0.00	0.00
Max of AE	48.30	72.64	41.02
Empirical $\mathbb{P}(AE > 1)$	0.95	0.95	0.94
Empirical $\mathbb{P}(AE > 3)$	0.89	0.87	0.80
Empirical $\mathbb{P}(AE > 5)$	0.76	0.81	0.70
Empirical $\mathbb{P}(AE > 10)$	0.49	0.61	0.46

Conclusion: Boxscore information, regularization critical for improved player ratings. Still much work remaining.