Predicting Surgery Duration w. Neural Heteroscedastic Regression

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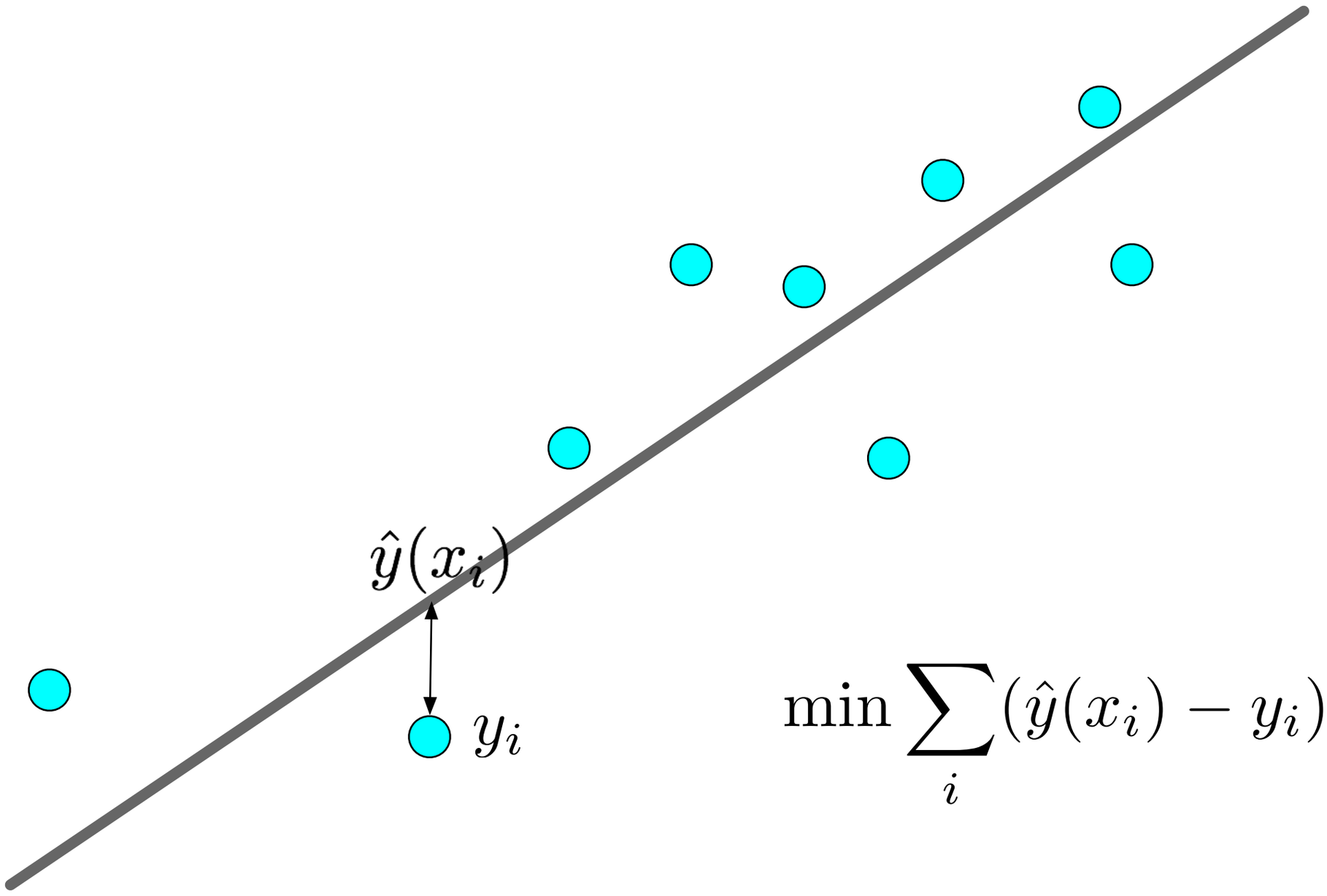
https://arxiv.org/abs/1702.05386

Predicting Surgery Duration

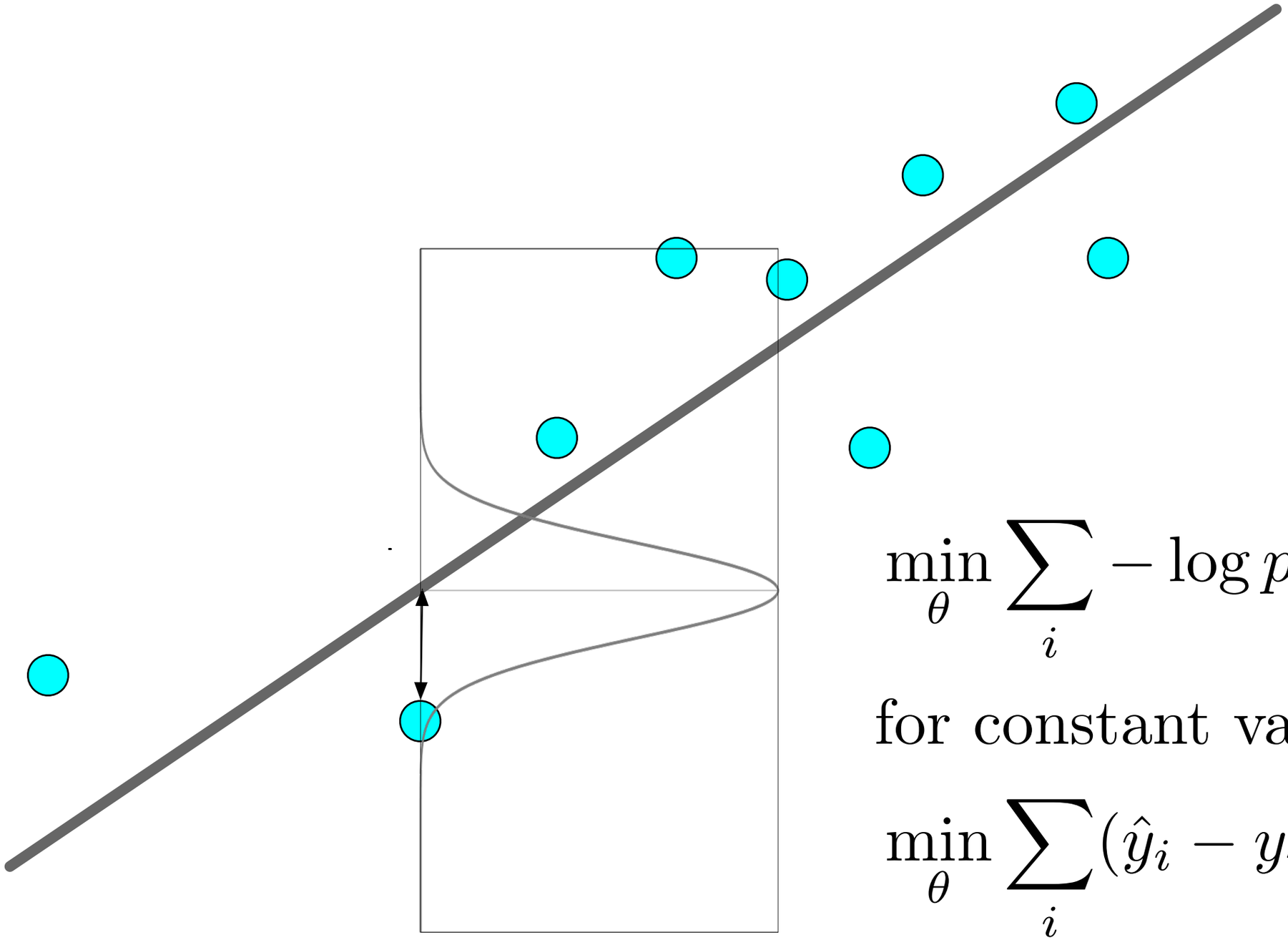
- Surgeries are expensive, partly due to cost of facilities
- More efficient use of operating rooms can lower costs
- Current scheduling: book avg. duration for that procedure
- **Neglects patient, doctor, and facility-specific details**
- **Neglects conditional variance**

Regression (Minimize Error)



$$\min \sum_i (\hat{y}(x_i) - y_i)^2$$

Regression (Probabilistic)



$$\min_{\theta} \sum_{i} -\log p(y_i|\hat{y}(x_i))$$

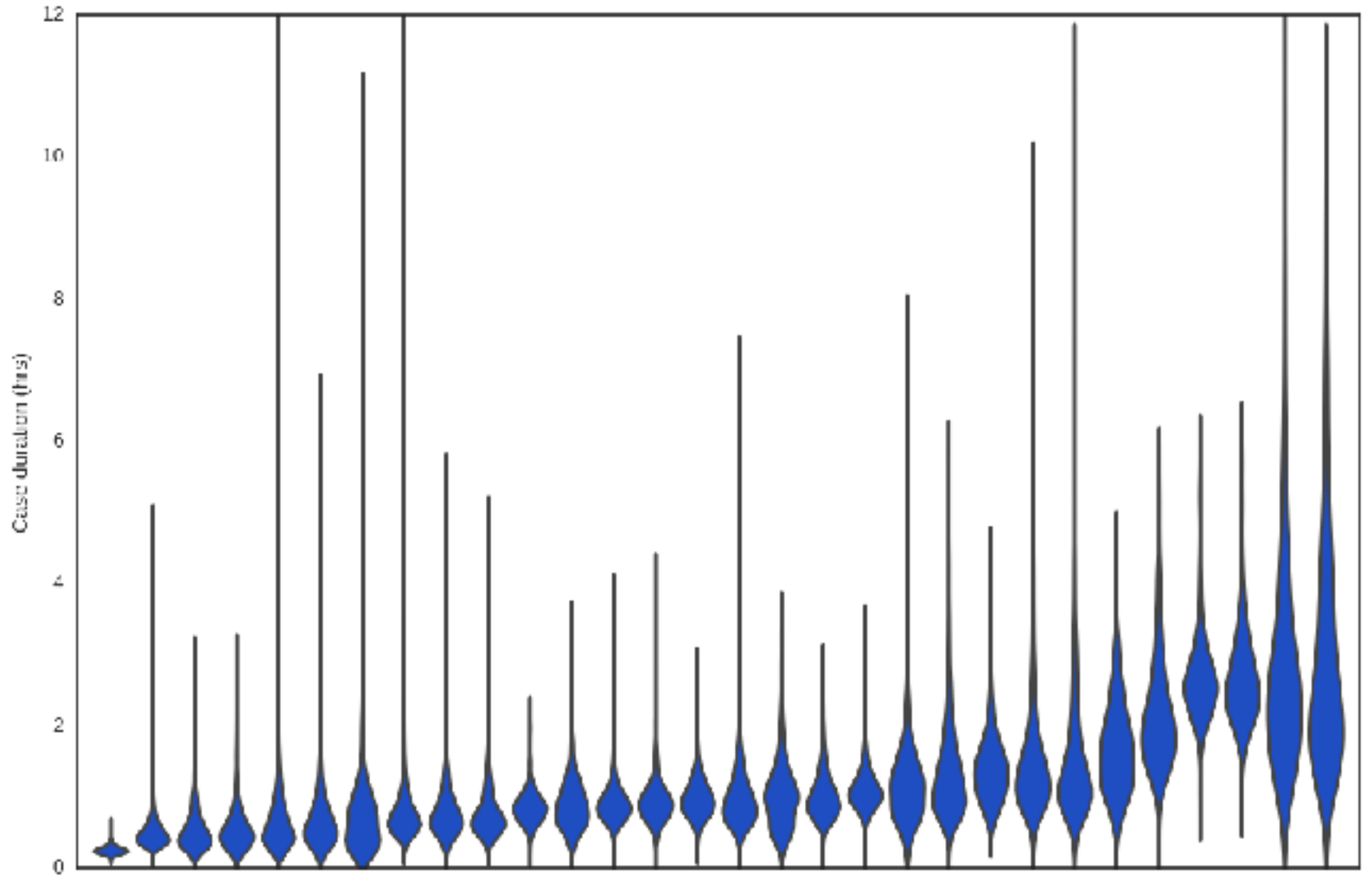
for constant variance:

$$\min_{\theta} \sum_{i} (\hat{y}_i - y_i)^2$$

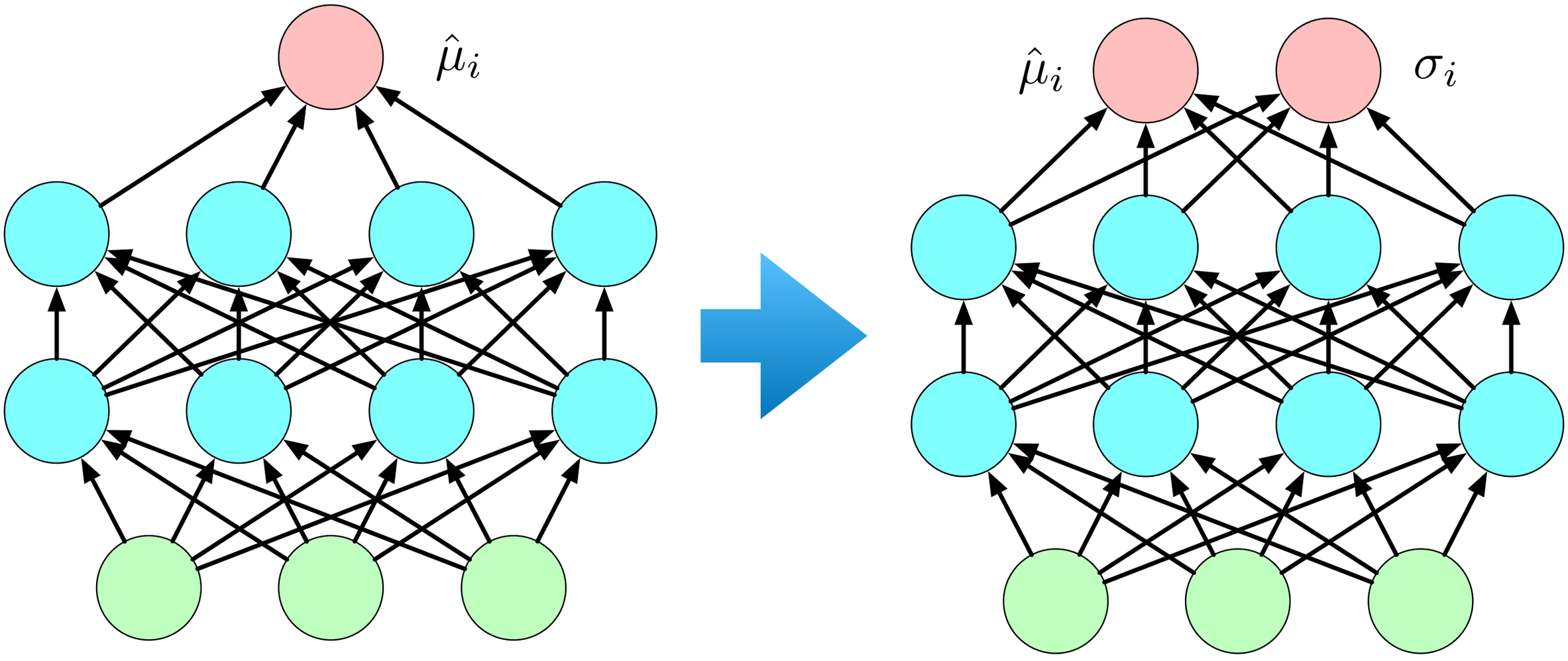
Two Problems

- In reality, variance is not constant
    1. The amount of variance **depends on** the patient, doctor, anesthesia, facility, and procedure
- The Gaussian is a preposterous likelihood function
    2. Surgeries **cannot** take **negative** duration

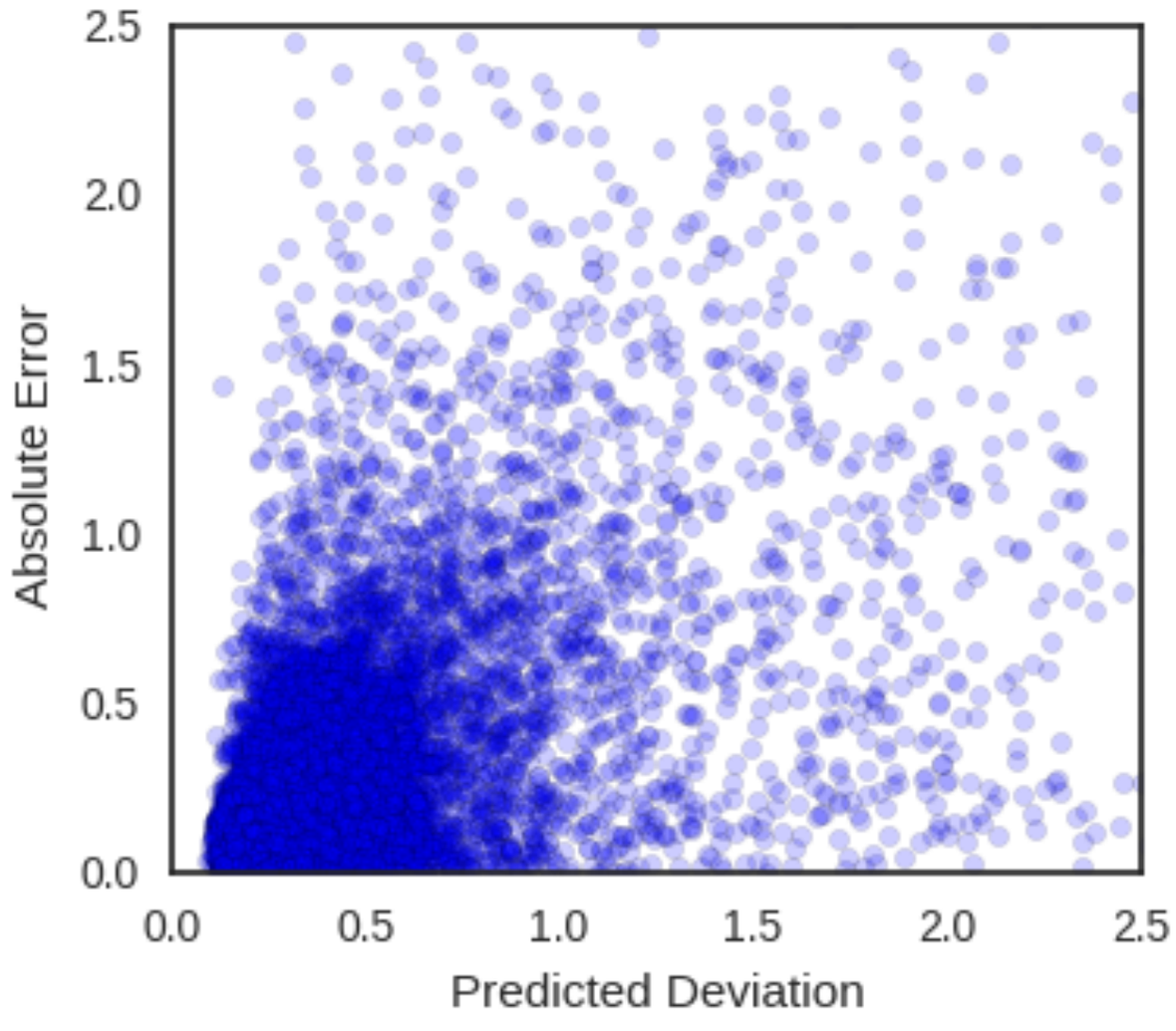
Heteroscedasticity



Heteroscedastic Regression



Predicted Deviation Scales with Actual Error

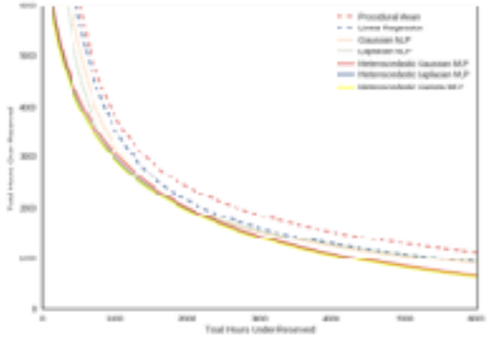


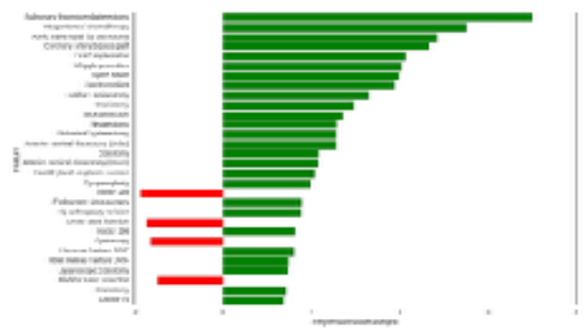
Results

Models	RMSE	MAE	NLL
Current Method	49.80	28.87	1.2385
Procedure Means	49.06	27.70	1.2222
Linear Regression	45.23	25.07	1.1446
MLP Gaussian	43.51	23.90	1.1102
MLP Gaussian HS	44.03	24.23	0.7325
MLP Laplace	44.24	**23.14**	1.0621
MLP Laplace HS	45.07	23.41	0.5034
MLP Gamma HS	**43.38**	23.23	**0.4668**

Thanks & Visit Our Poster

- Learn about economic tradeoffs (how to use this!)
- Qualitative analysis (what models tell us!)
- Recruit Nathan (Graduating next year!)





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