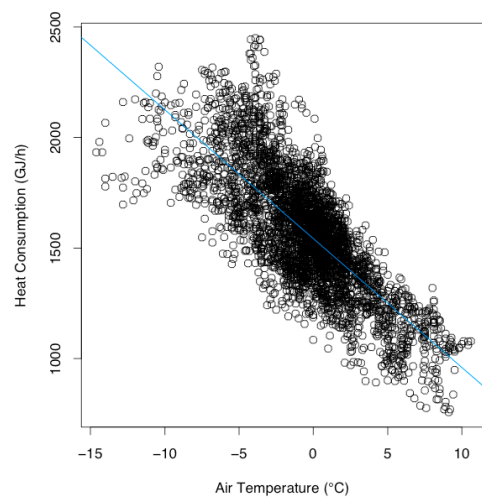
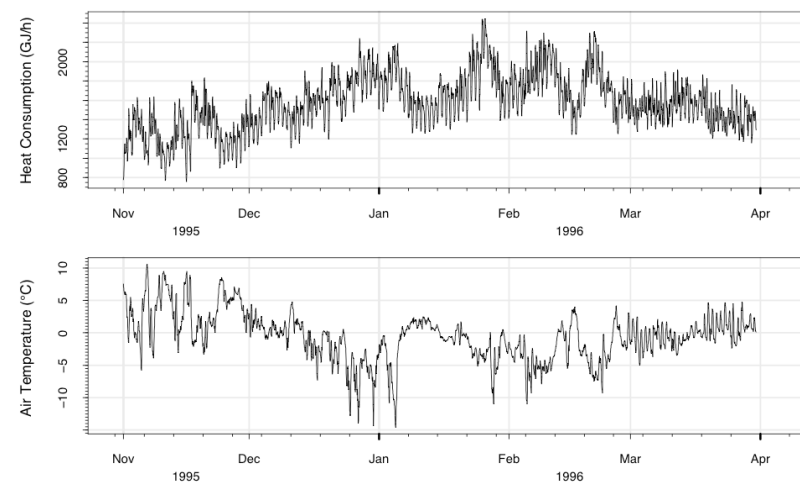


Time Series Analysis

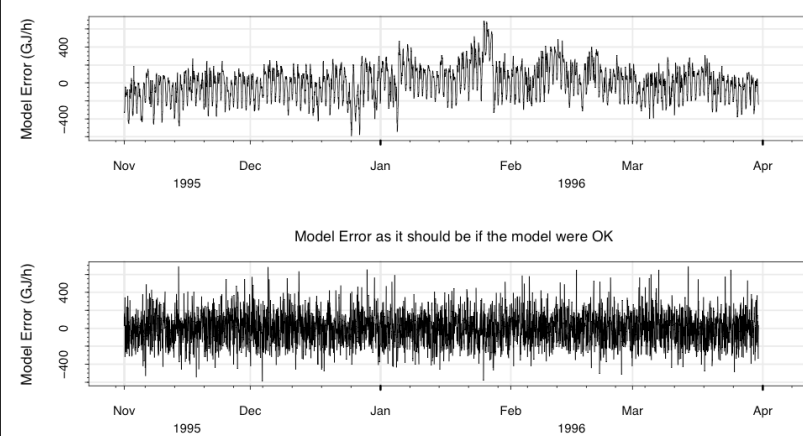
Fall 2017

Andreas Jakobsson

Consumption of district heating



Model Error



Conditional expectations

$$E\{Y|X = x\} = \int y f_{Y|X=x}(y) dy$$

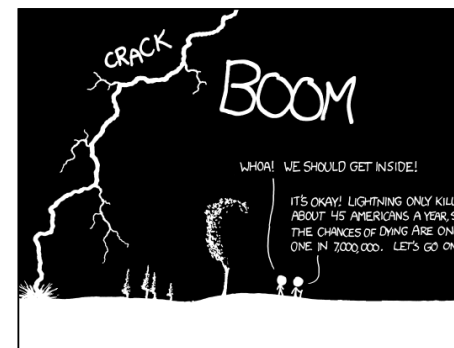
$$= \int y \frac{f_{X,Y}(x, y)}{f_X(x)} dy$$

$$E\{g(X)Y\} = E\{g(X)E\{Y|X\}\}$$

$$C\{Y, Z|X\} = E\{(Y - E\{Y|X\})(Z - E\{Z|X\})^T | X\}$$

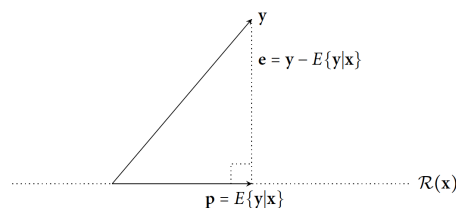
$$C\{Y, Z\} = E\{C\{Y, Z|X\}\} + C\{E\{Y|X\}, E\{Z|X\}\}$$

Conditional expectations



THE ANNUAL DEATH RATE AMONG PEOPLE WHO KNOW THAT STATISTIC IS ONE IN SIX.

Linear projection



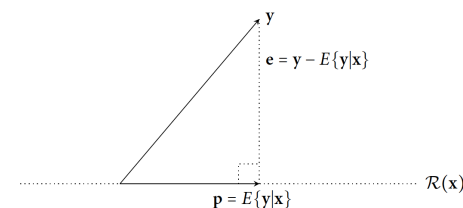
We defined the linear prediction of \mathbf{y} on to \mathbf{x} as

$$E\{\mathbf{y}|\mathbf{x}\} = \mathbf{a} + \mathbf{B}\mathbf{x}$$

Then, the prediction error is *orthogonal* with \mathbf{x}

$$C\{\mathbf{y} - E\{\mathbf{y}|\mathbf{x}\}, \mathbf{x}\} = \mathbf{0}$$

Linear projection



The optimal linear prediction is formed as

$$E\{\mathbf{y}|\mathbf{x}\} = \mathbf{m}_y - \mathbf{R}_{y,x} \mathbf{R}_{x,x}^{-1} (\mathbf{x} - \mathbf{m}_x)$$

with error variance

$$V\{\mathbf{e}|\mathbf{x}\} = \mathbf{R}_{y,y} - \mathbf{R}_{y,x} \mathbf{R}_{x,x}^{-1} \mathbf{R}_{y,x}^*$$