An Unknown Signal

Symbols, Patterns and Signals

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1 Least Squares Regression

The least squares calculations have been implemented in the `Segment` methods `lsr_polynomial` and `lsr_fn`. They both use the matrix formula: [1]

$$\boldsymbol{A} = (\boldsymbol{X}^T\boldsymbol{X})^{-1}\boldsymbol{X}^T\boldsymbol{Y}$$

Where in the case of the polynomial regression:

$$\boldsymbol{X} = \begin{bmatrix} 1 & x_0 & (x_0)^2 & .. & (x_0)^k \\ 1 & x_1 & (x_1)^2 & .. & (x_1)^k \\ .. & .. & .. & .. & \\ 1 & x_k & (x_k)^2 & .. & (x_k)^k \end{bmatrix}$$

Or in the case of the arbitrary function (f) regression:

$$\boldsymbol{X} = \begin{bmatrix} 1 & f(x_0) \\ 1 & f(x_1) \\ .. & .. \\ 1 & f(x_k) \end{bmatrix}$$

$\boldsymbol{Y}$ is a vector containing the y values y_0 through to y_k

And the result $\boldsymbol{A}$ is the list of coefficients, in the order $a_0 + a_1x + .. + a_kx^k$ or $a_0 + a_1f(x)$.

Calculating the Error

The Sum Squared Error (SSE) is a method of measuring how well a fitted function (f) fits a dataset of n points, by calculating the difference between the predicted and actual data. [2]

$$SSE = \sum_{i=0}^{n}(y_i - f(x_i))^2$$

This has been implemented in the `ss_error` function, which is called with an array of predicted y values, and array of actual y values.

2 K-Fold Validation

3 Testing

4 Training Data

References

[1] E. W. Weisstein, *Least squares fitting–polynomial*. [Online]. Available: `http://mathworld.wolfram.com/LeastSquaresFittingPolynomial.html`.

[2] ——, *Least squares fitting*. [Online]. Available: `https://mathworld.wolfram.com/LeastSquaresFitting.html`.