Notes on Least Squares and Nearest Neighbors

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# Linear Models and Least Squares

The linear model is defined as:

Given a vector of inputs the output is predicted as:

(1)

where is the *intercept* or *bias*. Often, we include a unit constant ‘variable’ additionally in X and include the bias in the vector of the coefficients . Then we can rewrite (1) as :

(2)

where denotes a row vector or matrix transpose ( is a column vector).

Here we are modeling a single output so is a scalar; in general can be a -vector, in which case would be a matrix of coefficients. In the – dimensional input-output space, represents a hyperplane. If the constant is included in , then the hyperplane includes the origin and is a subspace; If not, it is an affine set cutting the -axis at the point

# Appendix

## Affine Space

### Informal discussion

Affine space is what is left from vector space after one has forgotten which point is the origin.

Imagine that there are two observers – observer A and observer B. Observer A knows the real origin but Observer B believes that another point is the origin

Origin according to observer A

Origin according to observer B

*according to origin A*

*according to origin B*

according to origin A

*according to origin A*

Figure: origins and vector computations from the perspectives of observer A (red) and observer B (blue)