Linear Classification

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Two major components, a score function and loss function:

**Score Function:** Assume there is a training set x ∈RD, each having a label yi. Let I be from 1,...,N and y­­­I which is from 1,…,K. That is we have N examples, each with dimension D, and K labels. We desire a function f:RD→RK that maps images (in pixel form) to class scores.

We start with the simplest function

In the equation we assume that the image xi has the pixels flattened to a single column vector (1xD). W is a matrix of size KxD and b is a vector of size Kx1. W is called the weights and b is called the bias vector.

Note:

* Out goal is to get W and b to give correct classifications for the entire training set, once we have these we discard the training set

Each row of w represents a template image of the category.

Important to preprocess image as this by centering each pixel at 0.

**Loss Function:** Helps to measure unhappiness with the outcome of the score function. Commonly used loss is called the Multiclass Support Vector Machine. The SMV wants the correct class for the image to have a score higher than the incorrect classes by at least Δ.

Precisely the score function will give a vector of class scores, call that s. The multiclass loss for the ith example image is

The 0 assures that we only care about differences at least Δ. Our goal is to minimize this function.

Look at data for Regularization

**Setting Δ:** Set to 1.0 in all cases.

**Softmax:**