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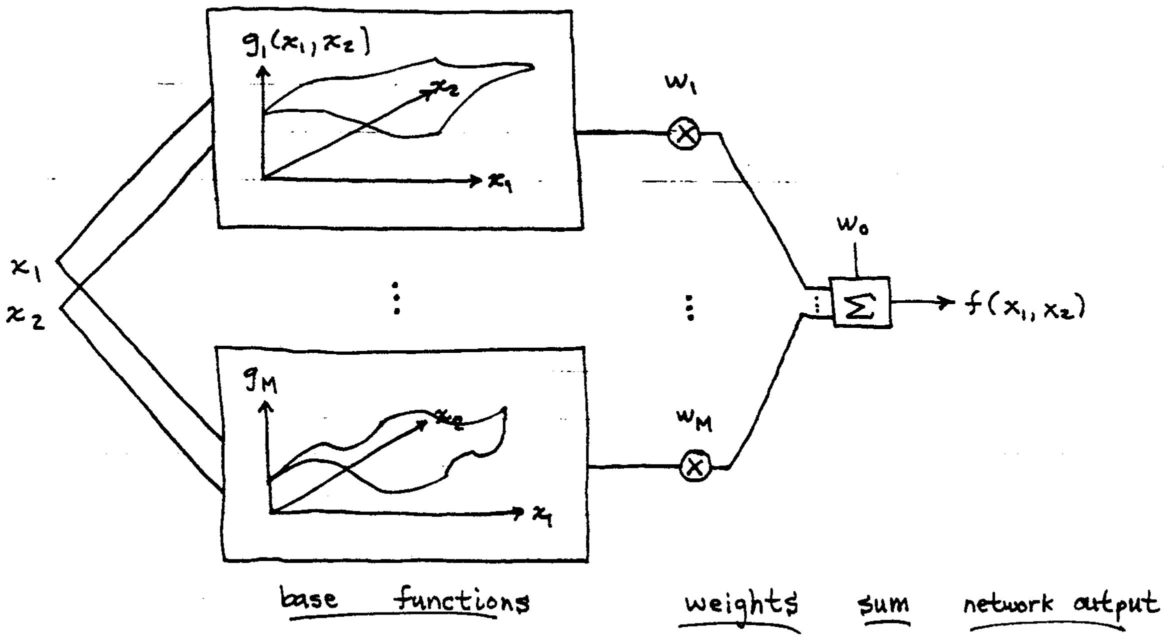
Function approximation methods generally belong to one of two classes:

1) weighted base function networks, or
2) Interpolation algorithms (described later on)

A weighted base function has the following generic architecture:



Here, we show a network with only two inputs, but we could have many inputs, $x_1, \ldots, x_N$. Our base functions in that case would accept all N inputs.

The term "base function" is a term invented here to describe functions that play a role similar to basis functions in linear transform theory.

If we write a formula for our generic network we see that it is a weighted sum of basis functions:

$$f(x_1, \ldots, x_N) = \sum_{j=1}^{M} w_j g_j(x_1, \ldots, x_N) + w_0$$

The weights $w_1, \ldots, w_M$ indicate how much of each base function is present in the output $f(x_1, \ldots, x_N)$.

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ex: In the discussion that follows we consider base function networks applied to the problem of controlling a motor in a reversing mill that rolls steel. The motor runs a worm screw that changes the roll gap of the mill. The mill is illustrated on the following page, with double arrows indication the direction of movement for changing the roll gap. The roll gap determines how much the thickness of the steel bar changes as it goes through the mill.

The motor we wish to control is run by a constant potential controller. The controller uses contactors (big relays) to switch motor current on and off. When the current switches off, the motor coasts for a distance called the "stop distance." To achieve accurate positioning we must predict the stop distance.

The stop distance is a function of two variables: $x_1 \equiv$ move distance, and $x_2 \equiv$ final position. Move distance affects the stop distance because the motor achieves a higher speed on long moves. Final position affects the stop distance because the friction on the motor varies with the position or roll gap.

In the following subsections, we consider various types of base function networks that predict the stop distance. The figures in these subsections show the form of the base functions and examples of functions computed by such networks.

Each type of network is also described in detail in its own section of conceptual tools.

Reversing Mill