Introduction to Backprojection

Whenever the physical quantity being measured is known to be a line integral of some quantity from the source to the receiver (examples: traveltime in seismic transmission tomography or X-ray attenuation in X-ray tomography), then it is natural to consider an approximate inversion method called "backprojection." The physical idea is simple: for lack of other information, we will assume that the contributions to the integral came equally from each point along the line of integration.

A Backprojection Formula

We assign a set of values to each model region through which the line intregrals pass, and then do a "simple" average over the values accumulated for each region, after all the line-integral data have been considered. Using traveltime tomography as our example, let $L_i = \sum_j l_{ij}$ be the total path length through all j cells for the ith source receiver pair. Then,

$$s_j = \frac{1}{C_j} \sum_i \frac{l_{ij} t_i}{L_i}$$

or

$$s = C^{-1} M^T L^{-1} t$$

is one possible example of a backprojection formula.