# Hand Writing

## Mixture of Bumps

To extend the minimization problem to a mixture of 2D bump functions, you need to define the log likelihood of the mixture of bump functions. Here's how you can write the log likelihood for a mixture of 2D bump functions:

Let's assume we have bump functions, each with its own set of parameters. The log likelihood of the mixture of bump functions is given by:

Where:

* *n* is the number of bump functions in the mixture.
* N*i*​ is the number of data points in group *i*.
* x*j*​ is the j-th data point in group i.
* ***θ****k*​ are the parameters of the *k*-th bump function.
* Bump(**x***j*​;***θ****k*​) is the value of the *k*-th bump function at the point **x***j*​.
* *wk*​ are the weights associated with each bump function in the mixture. These weights should sum up to 1.

You would need to optimize the parameters ***θ****k*​ and the weights *wk*​ to maximize this log likelihood function.