We have developed an optimization method for automatic dyke delineation from observed magnetic gradient traverse data. A non-linear least squares algorithm is used to find model dyke parameters that best fit the computed gradient tensor data to the observed data. The eigen-system of the observed magnetic gradient tensor data is used to provide starting model dyke parameters for an iterative non-linear least squares solver. This greatly enhances the ability of the solver to find a plausible dyke model for matching observed and synthetic tensor gradients. The method works well on synthetic examples. A real case study with remanence, taken from the Platreef, shows that the gross observed gradient features can be recovered by our procedure, but the residuals in the gradient fit hint strongly at the need for more complex dyke models.