

Fit Ellipse to a choice of points on a grid

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Fit_circle fits an ellipse (least square sense) to the chosen by the user points on the grid using directed random walk. The source code is in Python 3.8. Basic packages are used: numpy for vector matrix operations, random generators, pdist and cdist from distances package for fast Euclidean distance calculation. For Uix, Kivy is used for better integration with Python but also capability for mobile devices. PyInstaller was used to package for windows in a single exe file.

Fit_circle_D is a guided random walk. An ellipse is uniquely defined by 5 parameters: Center coords, 2 axis lengths and a slope. A random walk is thus initiated in a 5 dimensional space each point in this space representing a different ellipse. The initial parameter estimation is performed by means of mean point coords for the center, max of in-between points distances for the bigger axis and the mean of the same distances for the smaller axis. For estimating the ellipse slope a PCA treatment is used, where the dominant eigenvector of the covariance of the points coords matrix indicates the direction of maximum variance of point projections therefore a good estimate of the initial ellipse slope.

The mean square error is calculated in each iteration by adding each point's distances to the foci and taking the squared residual from the large axis. This is because for a point on the ellipse the sum of its distances to the foci is equal to the large axis. The process iterates 100 times at max. Every time the button is pressed it further improves by trying 100 more times (or at least trying).