# Multiple ellipses detection problem

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**Abstract.** The multiple ellipse fitting problem based on the given set of data points $\mathcal{A} \subset \mathbb{R}^2$ in a plane is considered. It has been supposed that all data points come from $k$ ellipses that should be fitted. The problem is extended to the case of a priorly unknown number of ellipses. If the Mahalanobis distance-like function is introduced, then an ellipse can be defined as a Mahalanobis circle. The application of the incremental algorithm or the Hough transformation does not give acceptable results. Therefore, the successive application of the `RANSAC` method with the control of a number of ellipses by Davies-Bouldin index is used. In this way an initial approximation is obtained, which is refined by the Mahalanobis $k$-means algorithm with application of a locally optimization method.

**Keywords:** Multiple ellipses detection; Center-based clustering; `RANSAC`; `DIRECT`

**Sažetak. Prpoznavanje više planarnih elipsi.** Razmatra se problem prepoznavanja više planarnih elipsi na osnovi skupa podataka $\mathcal{A} \subset \mathbb{R}^2$ u ravnini. Pretpostavlja se da podaci dolaze od $k$ unaprijed nepoznatik elipsi. Problem je proširen na slučaj unaprijed nepoznatog broja elipsi. Ako se uvede Mahalanobis kvazimetrička funkcija, onda elipse možemo promatrati kao Mahalanobis kružnice. Primjena inkrementalnog algoritma ili Houghovih transformacija u ovom slučaju ne daje prihvatljive rezultate. Zbog toga se sukcesivno primjenjuje `RANSAC` metoda uz kontrolu broja elipsi pomoću Davies-Bouldinovog indeksa. Tako dobivena početna aproksimacija konačno se profinjuje Mahalanobis $k$-means algoritmom uz primjenu neke metodom za lokalnu optimizaciju.

**Ključne riječi:** prepoznavanje više elipsi; grupiranje podataka; `RANSAC`; `DIRECT`