# Stereological determination of particle size distributions for similar convex bodies

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In the classical Wicksell problem spheres are randomly distributed in space. The problem is to estimate the size distribution of the spheres using the circular section profiles observed in a planar section. We study a generalization of this problem. Consider 3D particles, convex bodies to be precise, which are randomly distributed in space and randomly oriented. These particles all have the same shape, meaning they are all similar sets, but they do not have the same size. We cannot observe the particles directly, we only observe 2D section profiles of these particles in a planar section. We address the statistical problem of estimating the size distribution of the particles, using a sample of observed areas of the section profiles. A key insight in this problem highlights that we can separate the shape of the particles from their sizes in the sense that an observed area may be decomposed as the product of two independent random variables, one related to the particle size, one related to the particle shape. We describe a general and non-parametric estimation procedure which allows to deal with this problem for any choice of convex shape for the particles. Consistent estimation in this context is new.

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