

MACE 2006

Plate Matching by Key Figures

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Basic steps of the Algorithm

- preprocessing of the digital image, coordinate transformation and correction
 - search of the star catalogue and construction of the search figure
 - organization of the image objects in a searchable datastructure
 - The Matching Process, successive identity tests
 - image interrelation and search for moving objects
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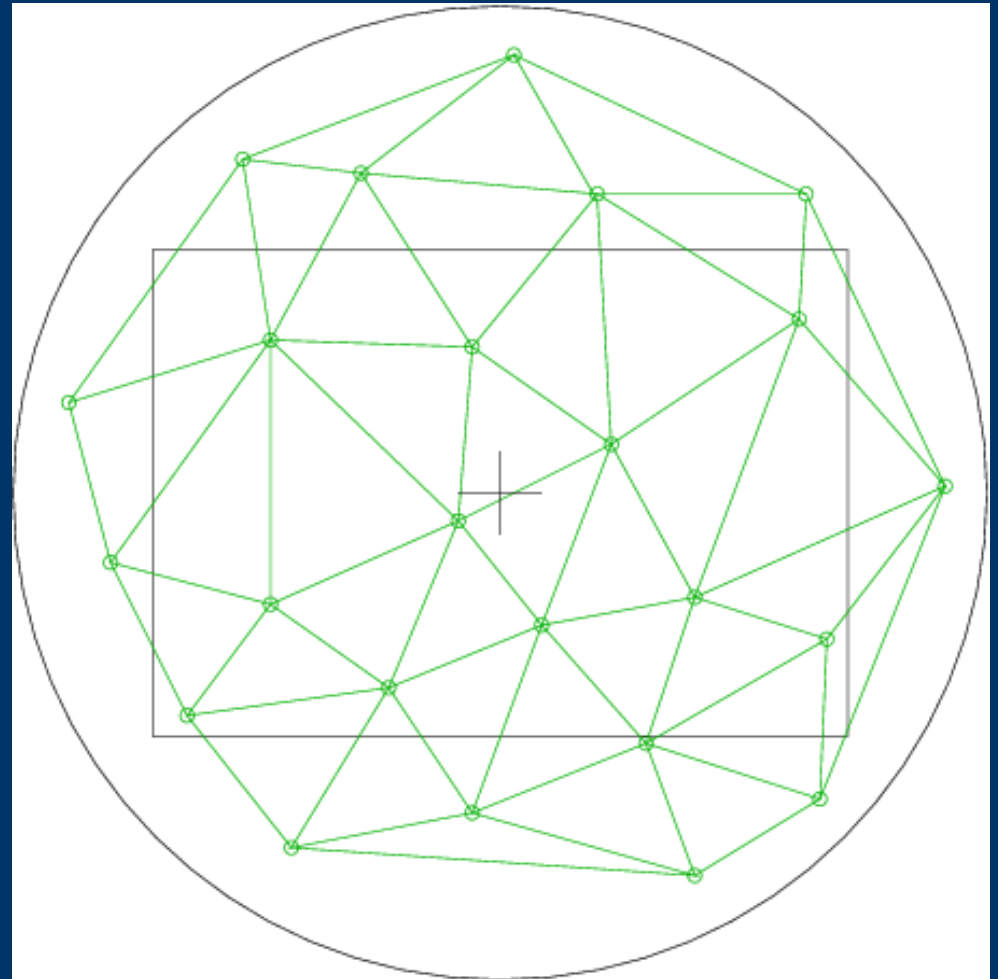
Requirements on the Image

- image scale and distortion must be known
- distortions can be compensated within tolerance
- estimate of the position of the image center
- the image contains every object that is considered bright enough and no reference star is obscured by a near bright star



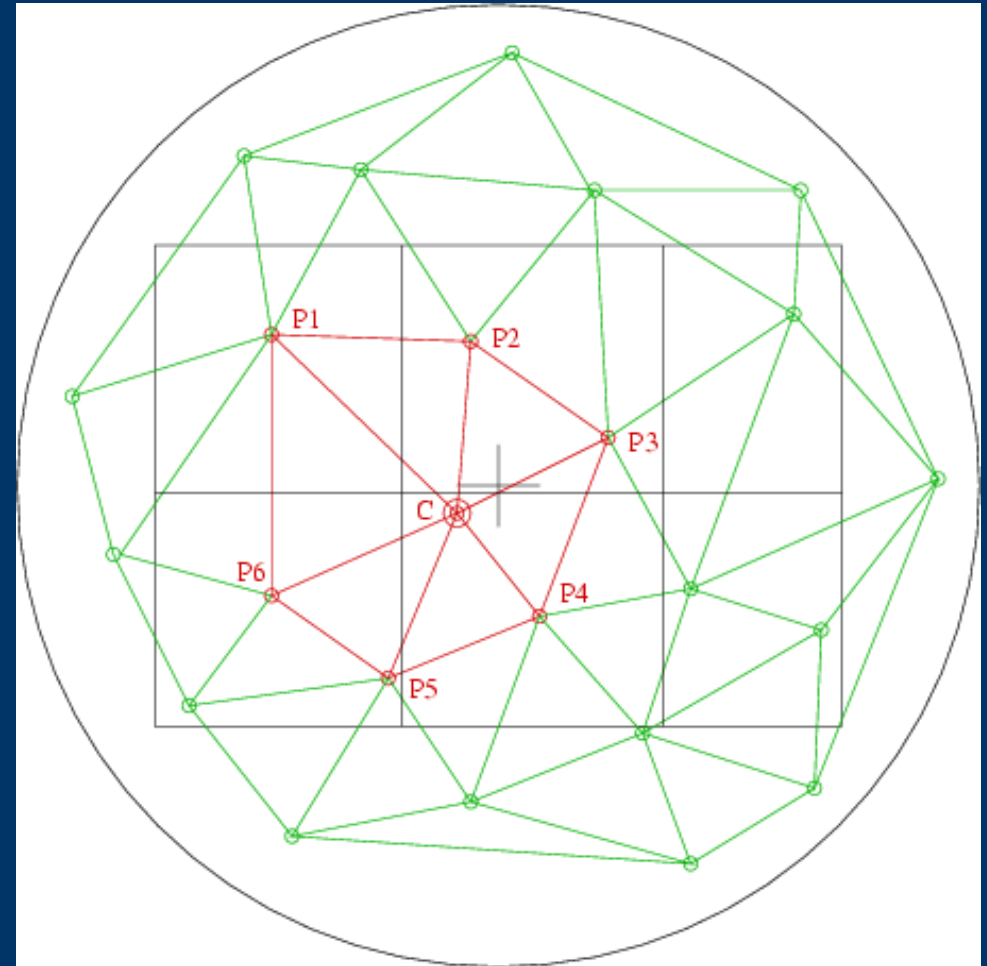
Database Preperation

- compute search radius
- read database
- Delaunay triangulation



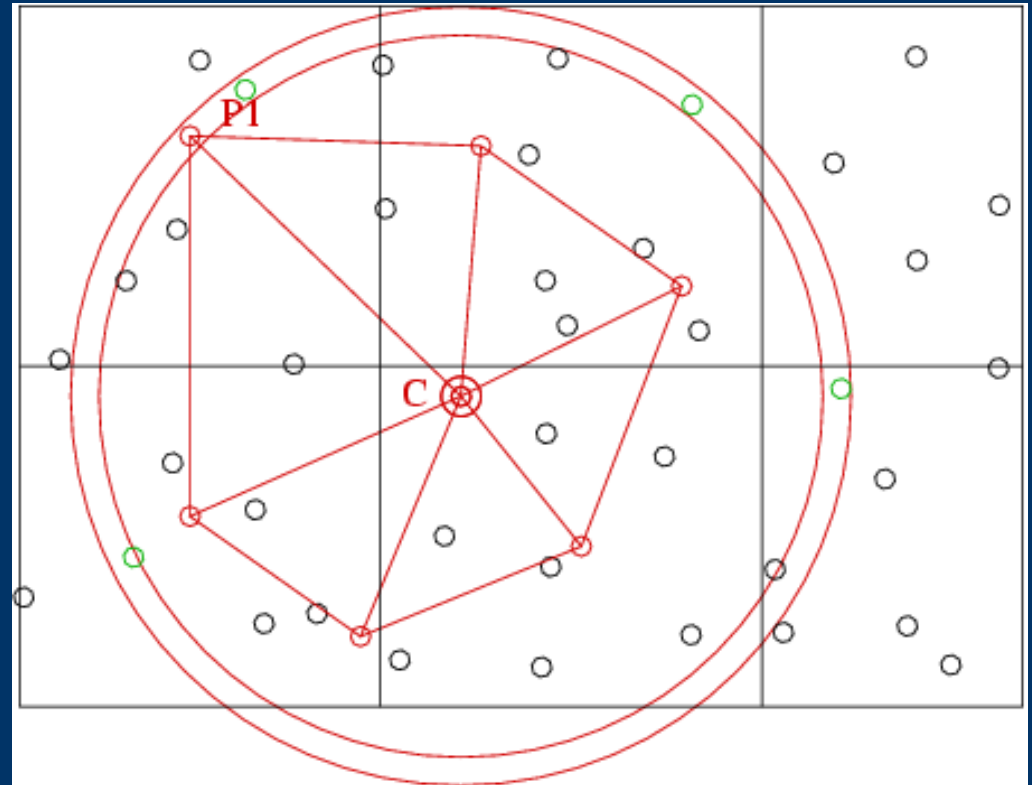
Construction of Key Figure

- select key center
- find neighbour ring
- compute extrema of pair distance
- define sector grid



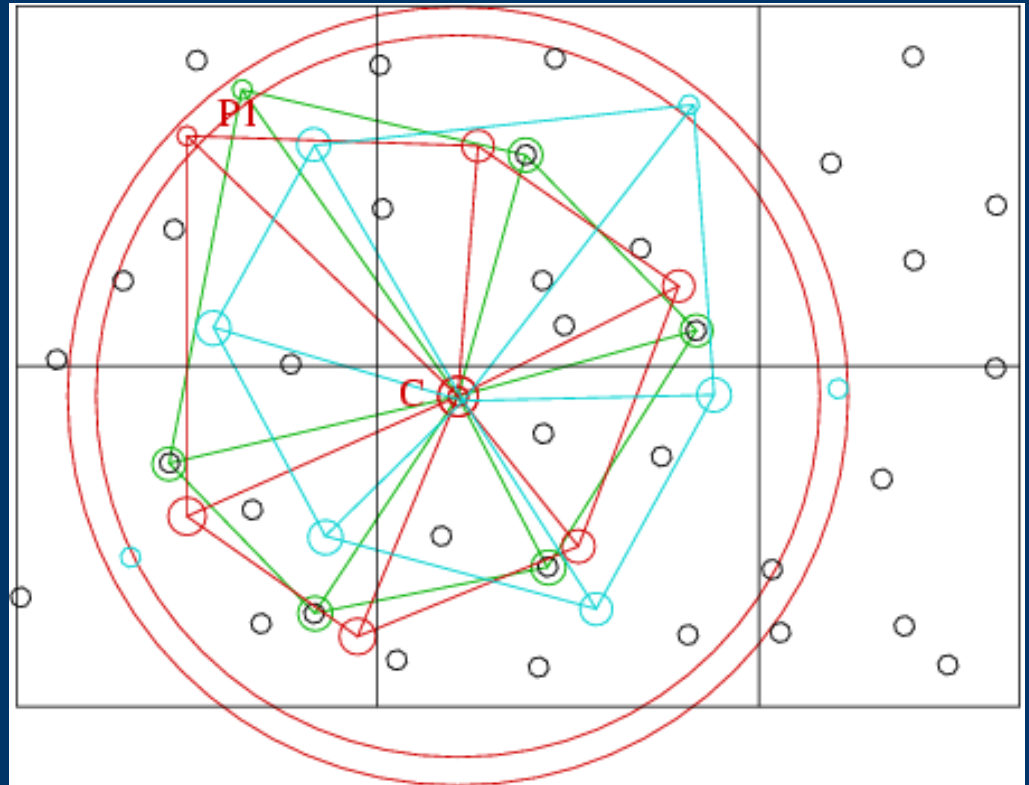
Primary Test Sequence

- sort objects by distance to center
- traverse objects
- compare distance
- (compare brightness)



Alignement & Final Tests

- transform other key stars
- compare distances and brightness of figure
- compare distance and brightness of all reference stars



Motion Detection

- compute direct plane transformation
- identify corresponding objects
- build pairs with non-corresponders of two images
- interpolate/extrapolate positions
- test interpolated positions



Features

- effort is proportional $M * N^2$ with
M... image area
N ... object density/catalog density
- invariant to rotation
- the better the estimate the shorter the search



Future Enhancements

- lazy evaluation of pairs and sectors
 - multiple key figures for large images
 - switch of key figure for large offsets
 - constrain absolute brightness if available
 - spherical coordinates for large areas
 - constrained arcs for moving object paths
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