WCS Fixer

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NVO Summer School

September 15, 2005

Motivation

- Number 2 on the NVO list of important things to do
- Necessary for observing temporal changes, e.g. supernovae detection
- Interesting problem with hard programming involved

General Overview

- Use Wesix to extract a source list for a FITs image (without cross matching)
- Determine area occupied by image
- Use Open SkyQuery to extract sources from a trusted database for area + offset
- Match catalogs to determine the necessary WCS correction

Matching Algorithm

- Find all possible triangles of points in both data sets
- Match up triangles by comparing the lengths of sides
- Matched triangles yield pairs of matched points
- Use RANSAC algorithm to calculate optimum similarity matrix

RANSAC Algorithm

- Pick 2 initial pairs of matched points (similarity matrices have 4 DOF)
- Calculate similarity matrix and apply
- Score result (e.g. sum of errors on newly rotated coordinates)
- Use neighbors within some sigma to recalculate similarity matrix
- Iterate until error score converges

Drawbacks

- Current implementation is very slow because matching is done via brute force
- Only works on test data...

Enter Sergey's Code

- Much faster -- implemented in C and uses tree searching for intelligent matching
- Actually works!

Demo

Future Direction

- Turns WCS fixing client into a web service
- Add support for robust automatic and interactive operation
  - Automatic for large batch jobs
  - Interactive for fine tuning