SourceXtractor++

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on behalf of SDC-CH
SExtractor2

- SExtractor2 (1995) is a very successful project (over 9,000 citations!)
- It introduced model fitting in 2010
- The limitations of the design started to become problematic
  - Multi frame measurement
  - Overlapping objects
  - Difficult to collaborate due to the intricacies of the code
SourceXtractor++

- Emerges as a collaboration inside the Euclid context with the original author of SExtractor 2, Emmanuel Bertin
- Complete redesign of the code
  - Object oriented (C++ with bits of Python)
  - Modular design, with clear separation of responsibilities
  - Possibility for third party plugins
- Aim to provide most of what SExtractor2 did, and more
  - Feedback very welcome on what's missing!
SourceXtractor++ new functionalities

- Multi-frame measurements
- Multi-frame model fitting, with support for overlapping sources over multiple images/bands/…
- Image handling based on tiles
Measurement frames
Each one can have its own weight map, variable PSF model, etc.
They can be grouped by almost any arbitrary consideration

Detection image
Detections are done on a co-added image first, and then projected into each individual frames using the WCS information

Weight image
Optional, but helps reducing spurious detections on the edges of the co-added image
Measurement apertures are configured on the reference frame of the detection image, and projected into the measurement frames.
Multiframe model fitting

\{ x, y, ratio, rad, angle, sersic \}

$G$

\{ flux_1 \}

$R$

\{ flux_2 \}

measurement_group

Model 1

Model 2
Detection frame

Model

\{ x, y, ratio, rad, angle, sersic \}

\{ flux_{1...n} \}

Source group center

Prior

Residual

Variable PSF

Source group center

Frame

High res. raster

High res. convolved raster

Downsampled raster

Residual

Measurement frame 1...n
Example of fitting of proper motions

- Point-source model on 36 simulated exposures
- **Variable point spread functions**
- Error bars automatically computed by SourceXtractor++
- The simulated star field has
  - 10% of stars that move at 10 mas/yr
  - Remaining 90% are at rest