Experiments with Recursive Estimation in astronomical image processing.

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Recursive estimation concepts were applied to image enhancement problems since the 70's. However, very few applications in the particular area of astronomical image processing are known (see e.g. Richter, G.M., 1978, *Astron.Nachr*, 299, 283). These concepts were derived, for 2–dimensional images, from the well–known theory of Kalman filtering in one dimension. The historic reasons for application of these techniques to digital images are related to the images' *scanned* nature, in which the temporal output of a scanner device can be processed on–line by techniques borrowed directly from 1–dimensional recursive signal analysis.

However, recursive estimation has particular properties that make it atractive even in modern days, when big computer memories make the full scanned image available to the processor at any given time. One particularly important aspect is the ability of recursive techniques to deal with *non-stationary* phenomena, that is, phenomena which have their statistical properties variable in time (or position in a 2-D image). Many image processing methods make underlying stationarity assumptions either for the stochastic field being imaged, for the imaging system properties, or both. They will underperform, or even fail, when applied to images that deviate significantly from stationarity. Recursive methods, on the contrary, make it feasible to perform *adaptive* processing, that is, to process the image by a processor with properties tuned to the images's *local* statistical properties.

Recursive estimation can be used to build estimates of images degraded by such phenomena as noise and blur. We show examples of recursive adaptive processing of astronomical images, using several local statistical properties to drive the adaptive processor, as average signal intensity, signal–to–noise ratio and autocorrelation function. Software was developed under IRAF, and as such will be made available to interested users.