

Image analysis in emcalc2

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EMSY and MOI related filters

Beamlets related filters

Background and sigma filter

$w \in [1; CameraWidth]$ $h \in [1; CameraHeight]$ $n \in [1; Nframes]$

Difference of average signal and average background for each pixel within the N frames:

$$SmB_{w,h} = \frac{1}{Nframes} \sum_n (S_{w,h,n} - B_{w,h,n})$$

Standard deviation of the each background pixel:

$$Brms_{w,h} = \sqrt{\frac{1}{Nframes} \sum_n S_{w,h,n}^2 - \left(\frac{1}{Nframes} \sum_n B_{w,h,n} \right)^2}$$

Filtering and MOI creation: If $SmB_{w,h} \leq Cut \cdot Brms_{w,h}$, where $Cut \in \mathbb{N}$ then $M_{w,h} = 0$, else $M_{w,h} = 1$.

Neighbors filters

Each filter applied N times, $N \in \mathbb{N}$.

Removing product filter:

$$M_{w,h} = M_{w+1,h} \cdot M_{w+1,h-1} \cdot M_{w,h-1}$$



If $M_{w,h} > 0$ then $M_{w,h} = 1$.

Restoring sum filter:

$$\begin{aligned} M_{w,h} = & M_{w+1,h} + M_{w+1,h-1} + M_{w,h-1} + \\ & + M_{w-1,h-1} + M_{w-2,h-1} + M_{w-2,h-1} + \\ & + M_{w-2,h-1} + M_{w-3,h-1} \end{aligned}$$



If $M_{w,h}$ then $M_{w,h} = 1$ - MOI created.

$EMSY_{w,h} = M_{w,h} \cdot (SmB_{w,h} > Cut \cdot Brms_{w,h})$

- EMSY created.

Subtracting of average background

Each filter applied only in MOI region.

$n \in [1; N_{\text{beamlets}}]$

Subtracting average background over all beamlets from each beamlet:

$$SmB_{w,h,b} = S_{w,h,b} - \sum_b B_{w,h,b} \quad (1)$$

Standard deviation of the each background pixel:

$$Brms_{w,h} = \sqrt{\frac{1}{N_{\text{beamlets}}} \sum_b S_{w,h,b}^2 - \left(\frac{1}{N_{\text{frames}}} \sum_b B_{w,h,b} \right)^2}$$

Each beamlet filtering: If $SmB_{w,h,b} \leq Cut \cdot Brms_{w,h}$, where $Cut \in \mathbb{N}$ then $SmB_{w,h,b} = 0$.

Neighbors filter

Each filter applied N times, $N \in \mathbb{N}$.



Removing product filter:

$$\begin{aligned}
 M_{w,h,b} = & SmB_{w+1,h,b} \cdot SmB_{w+1,h-1,b} \cdot SmB_{w,h-1,b} \cdot \\
 & \cdot SmB_{w-1,h-1,b} \cdot SmB_{w-1,h,b} \cdot SmB_{w-1,h+1,b} \cdot \\
 & \cdot SmB_{w,h+1,b} \cdot SmB_{w+1,h+1,b}
 \end{aligned}$$

If $M_{w,h,b} == 0$ then $SmB_{w,h,b} = 0$

Strange filter:

$$\begin{aligned}
 M_{w,h,b} = & SmB_{w+1,h,b} + SmB_{w+1,h-1,b} + SmB_{w,h-1,b} + \\
 & + SmB_{w-1,h-1,b} + SmB_{w-1,h,b} + SmB_{w-1,h+1,b} + \\
 & + SmB_{w,h+1,b} + SmB_{w+1,h+1,b}
 \end{aligned}$$

If $M_{w,h,b} \leq 0$ then $SmB_{w,h,b} = 0$.

Thank You for attention!

...and apologize for a not DESY style, this is my first experience to create slides with \LaTeX , unfortunately DESY doesn't provide \LaTeX template. Hope for a next time I will create my own \LaTeX theme corresponds to DESY design.