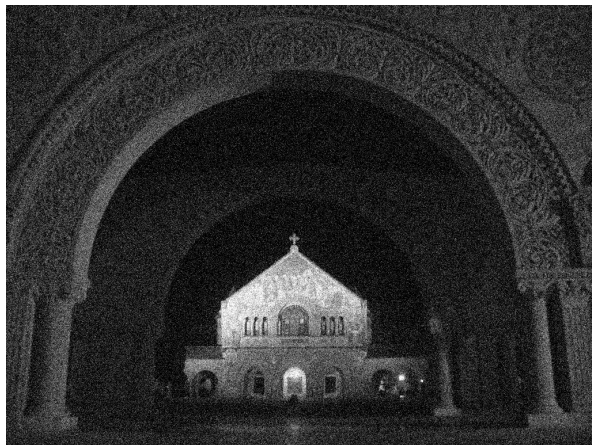


Point operations for combining images

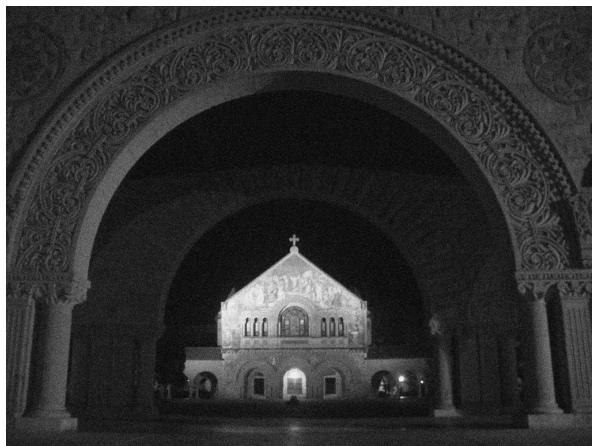
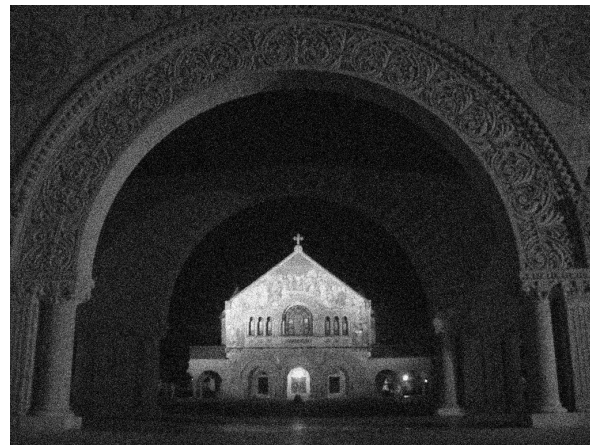
- Image averaging for noise reduction
- Combination of different exposures for high-dynamic range imaging
- Image subtraction for change detection
- Need for accurate alignment

Image averaging for noise reduction

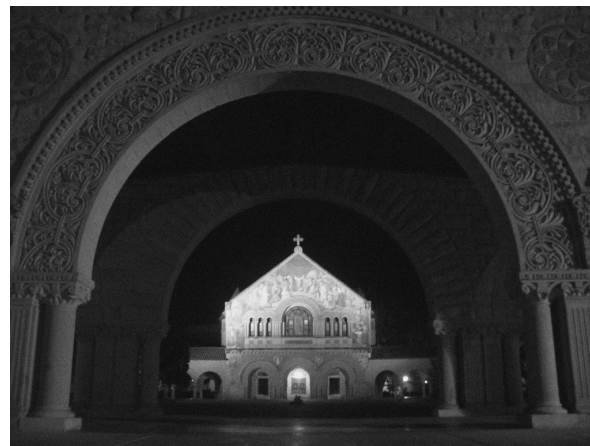
1 image



2 images



8 images



32 images



High-dynamic range imaging



-8 f-stops



-2 f-stops



+2 f-stops



+4 f-stops



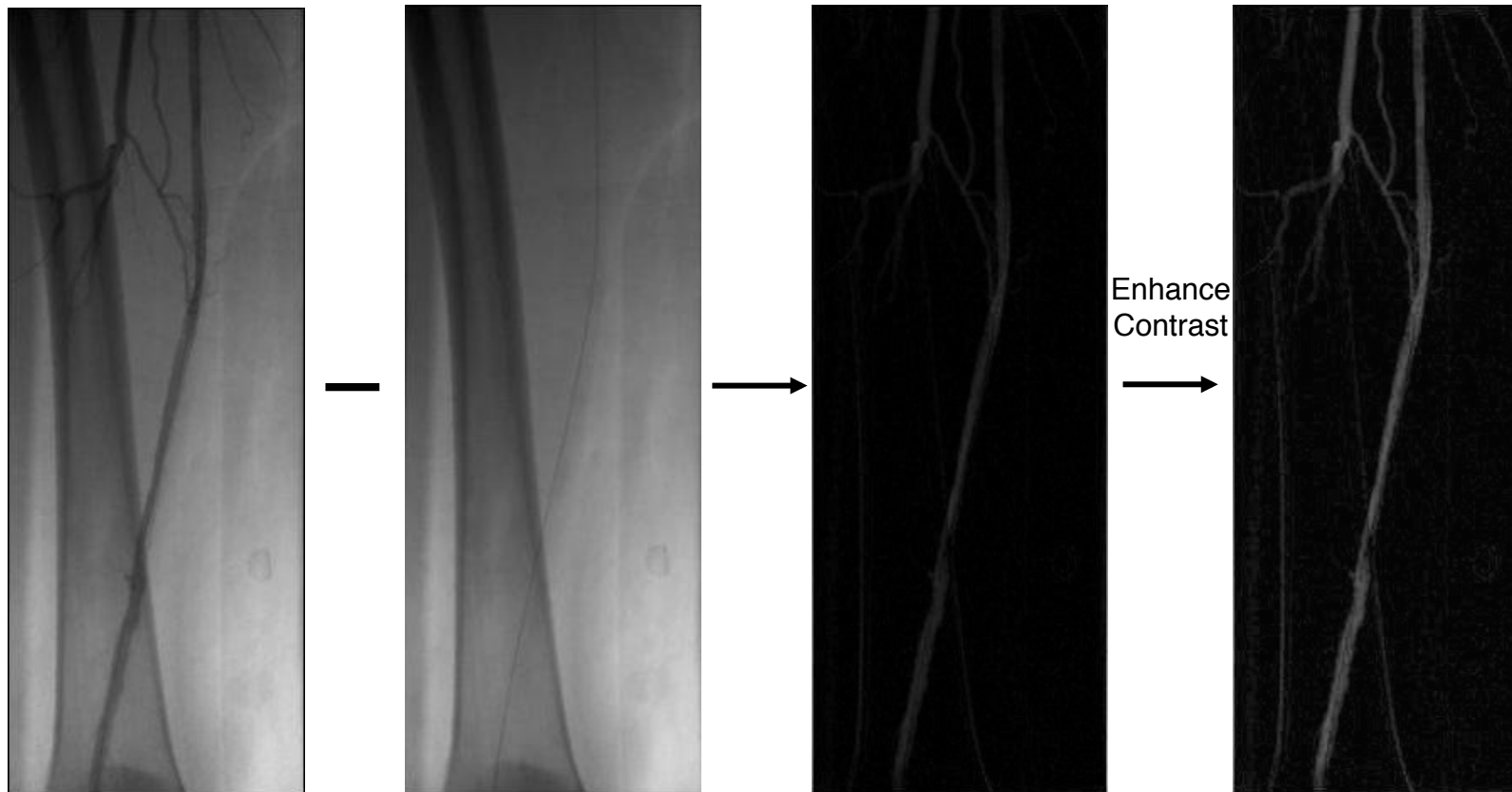
Blended image from
Exposure Fusion

[Tom Mertens et al. 2007]

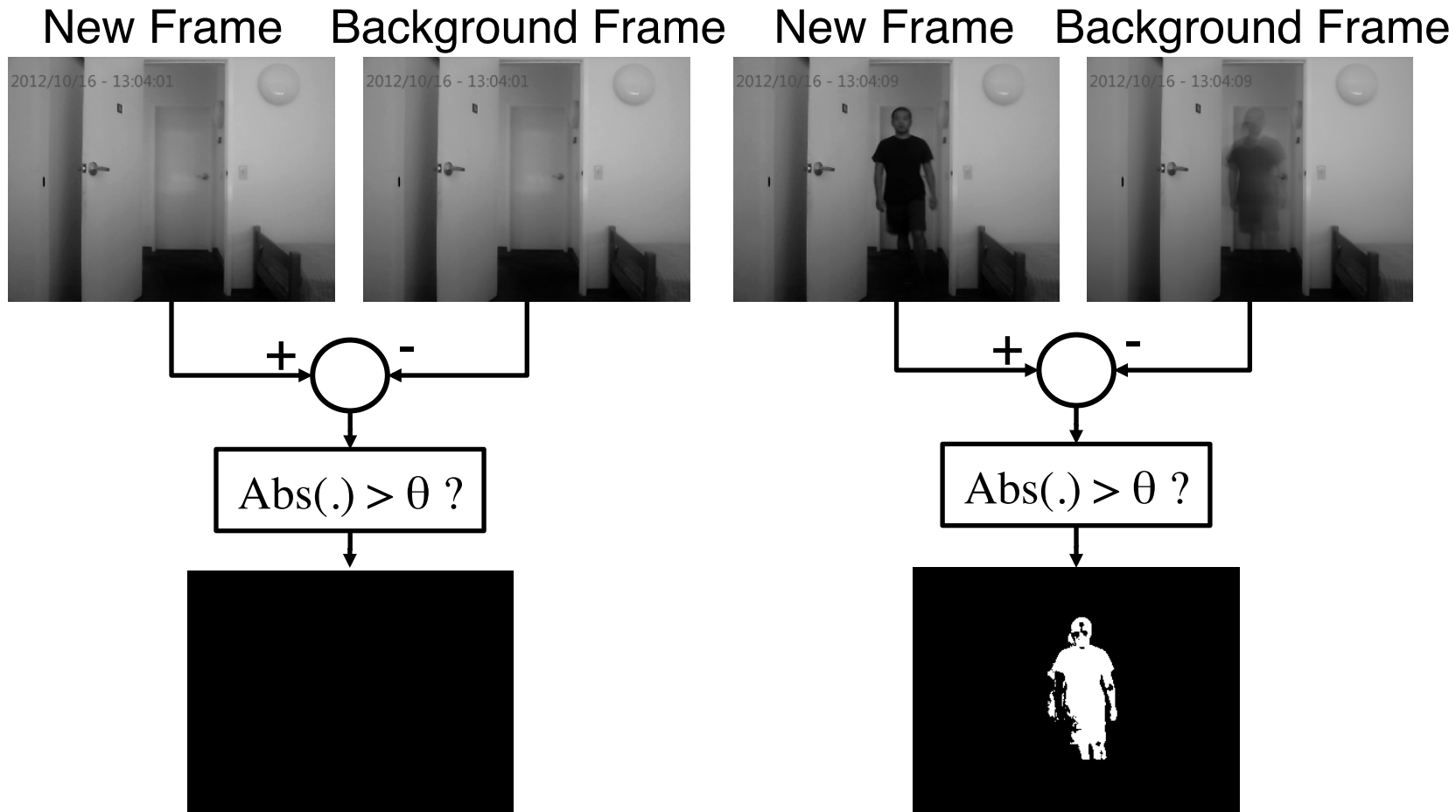


Image subtraction

- Find differences/changes between 2 mostly identical images
- Example: digital subtraction angiography



Video background subtraction

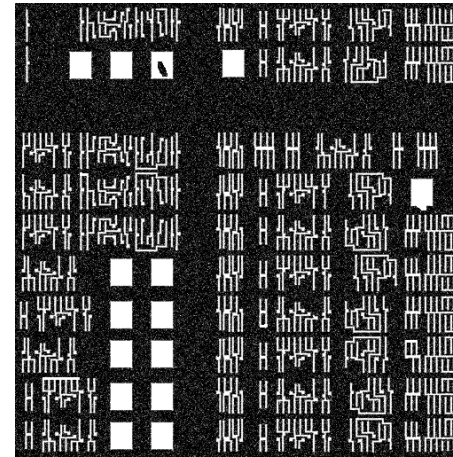
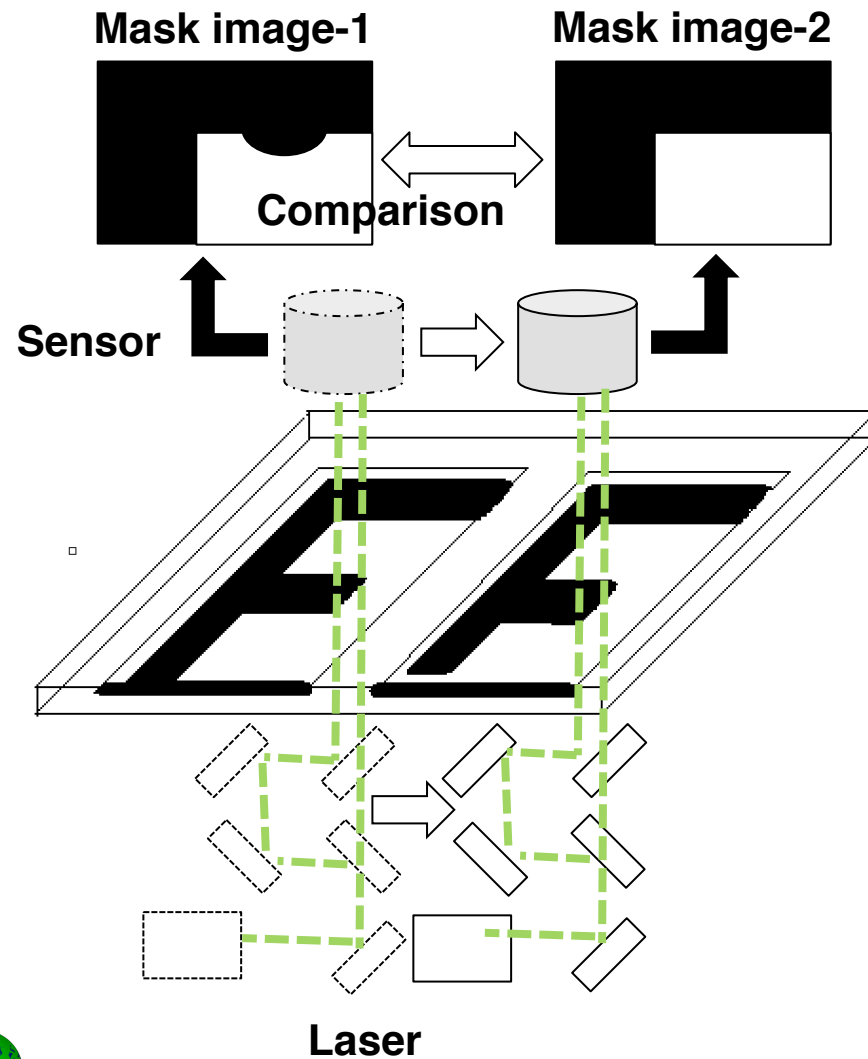


Update:

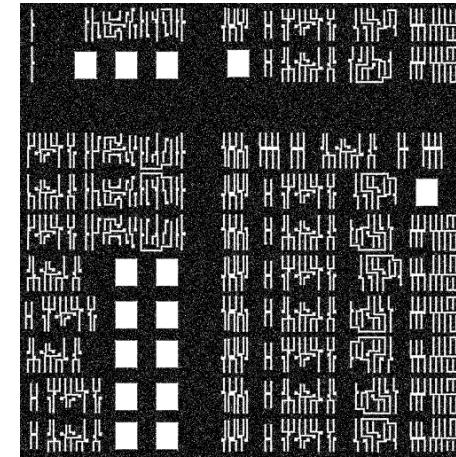
$$\text{Background}[t] := \alpha \text{Background}[t-1] + (1 - \alpha) \text{New}[t]$$



Image subtraction in IC manufacturing: inspection of photomasks



Mask image-1



Mask image-2



Difference image



Where is the defect?

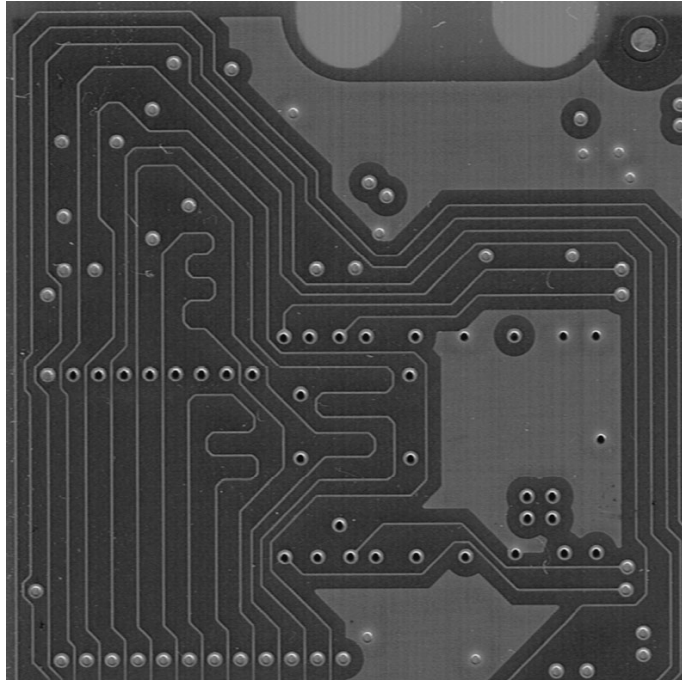


Image $g[x,y]$ (no defect)

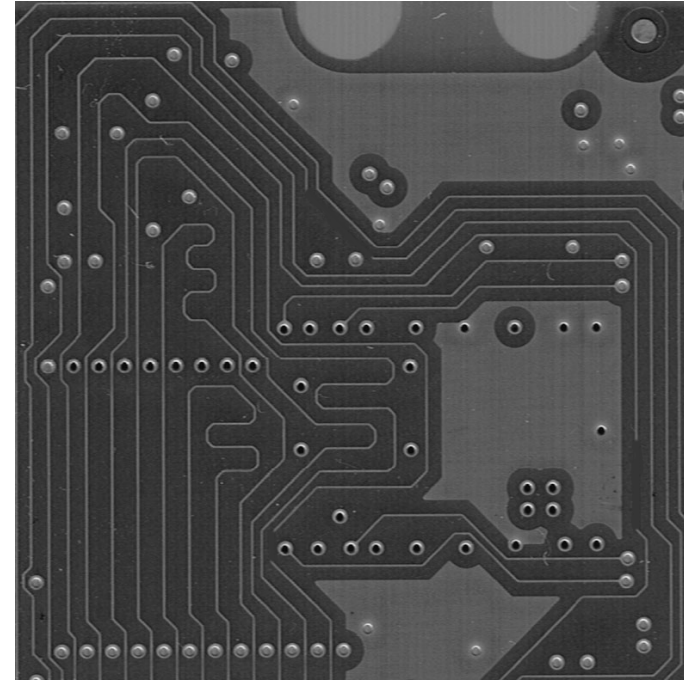
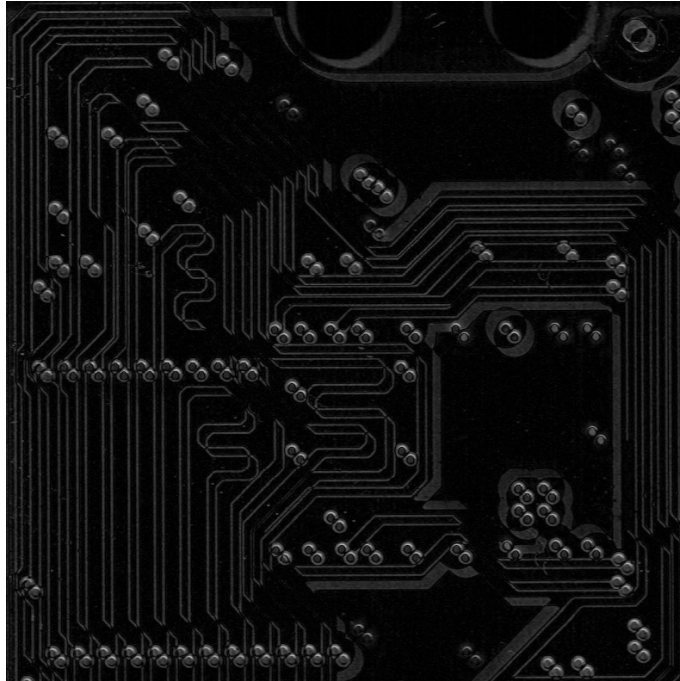


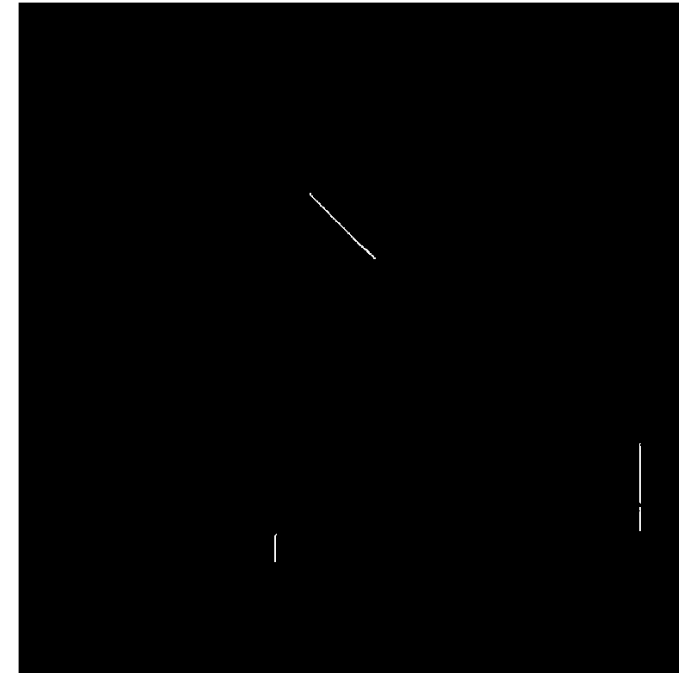
Image $f[x,y]$ (w/ defect)



Absolute difference between two images



$|f-g|$ w/o alignment



$|f-g|$ w/ alignment

