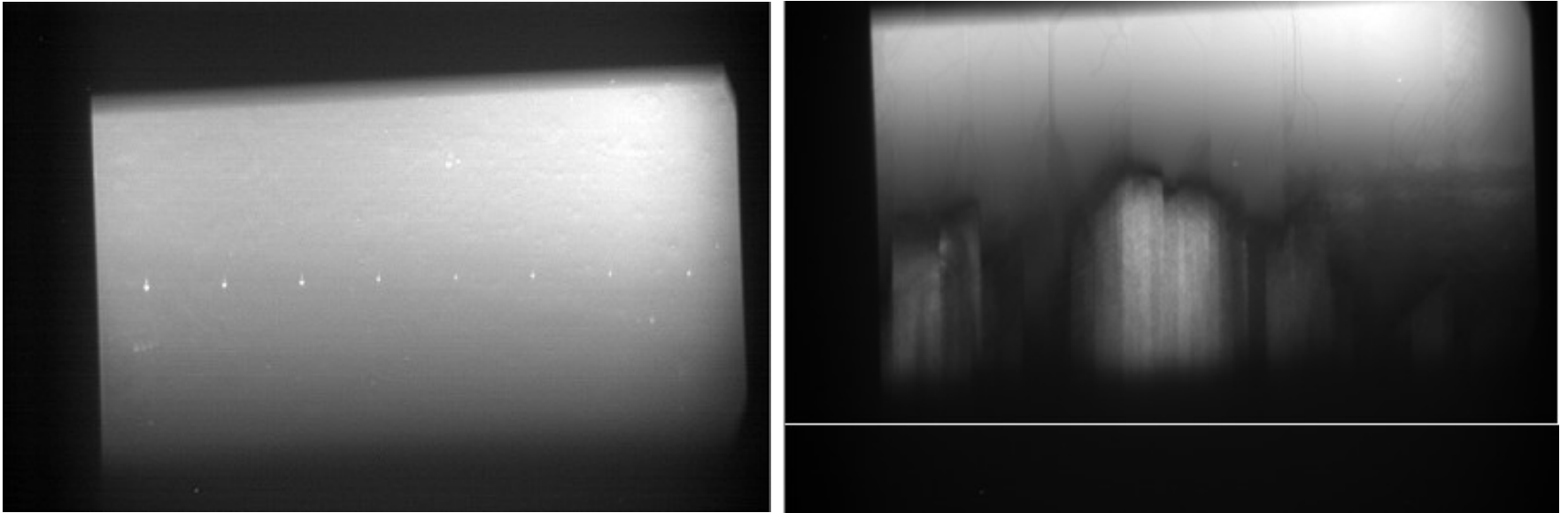


Shift Detection. Status Report.

Vladimir Reznichenko, 01-July-2011

Global shift



Right picture has shift 200 pixels by y-axis and 1 pixel by x-axis

Alternatives

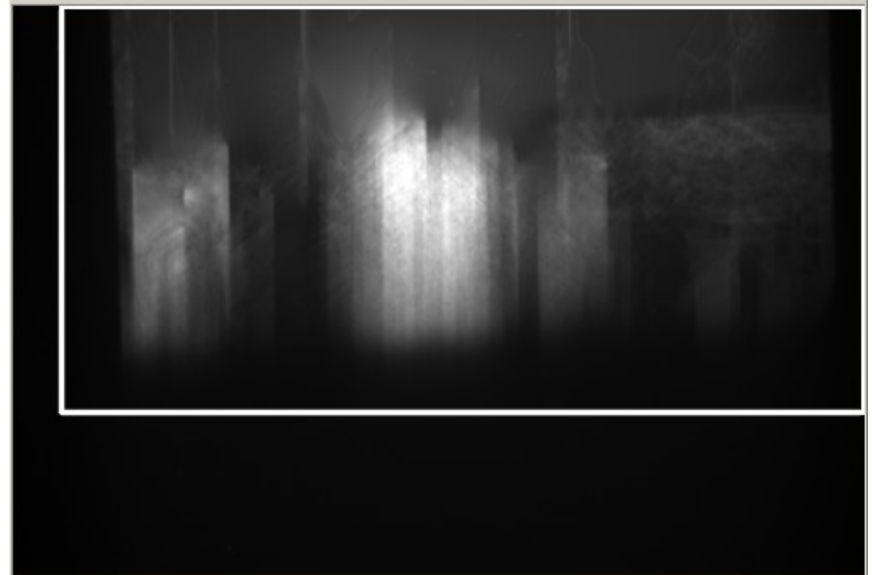
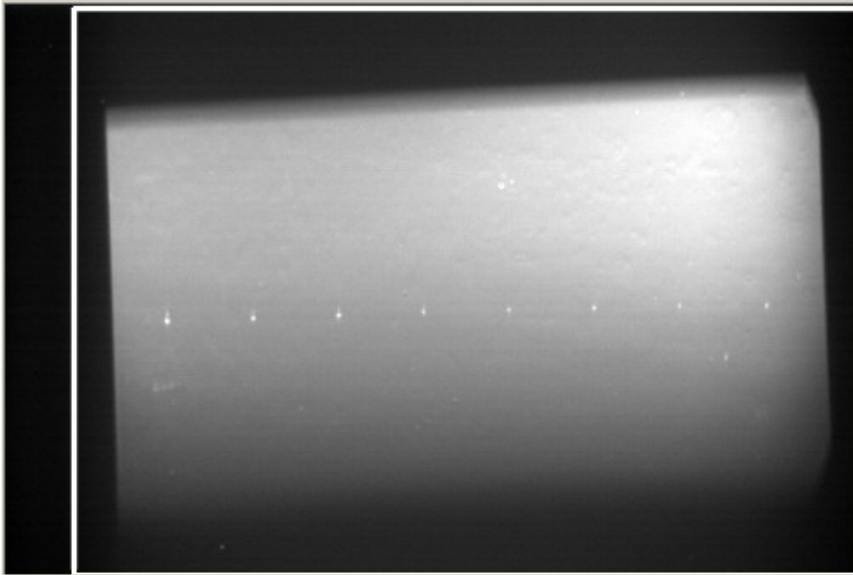
- Spectrum based analysis (FFT transformation, correlation)

Not stable for cases of illumination changes, structure changes (deformation, rotation etc.)

- Optical flow methods

There are lot of different methods and techniques with different complexity. Basically quite complicated or requires image preprocessing for stable results.

Region of interest (ROI)



- Track only region of interest, omitting rest part of image to reduce computations.

Also it is possible to reduce computations more efficiently by:

- using only part of ROI
- downsizing ROI

Similarity estimation

Problems:

- 1) Noise
- 2) Brightness changes
- 3) Sample structure changes

Solution: intensity based calculation:

$$R(x, y) = \frac{\sum_{x', y'} (T(x', y') - I(x + x', y + y'))^2}{\sqrt{\sum_{x', y'} T(x', y')^2 \cdot \sum_{x', y'} I(x + x', y + y')^2}}$$

T	template	$x' = 0 \dots w - 1, y' = 0 \dots h - 1$
R	result	$w \times h$ Image dimension
I	image	

This formula gives for ROI + border region similarity estimation.

Minimum value correspond to minimal differences between image and template.

Improvements

- Sector/weight based model to stabilize detection.

I / 0.5	II / 0.8	III / 0.5
IV / 0.8	V / 1	VI / 0.8
VII / 0.5	VIII / 0.8	IX / 0.5

Perspectives

Possible improvements

- GPU (CUDA) based implementation.

Applications:

- Sample positioning / camera adjustment.
- Topography
- Fast tracking separate objects (biology)