Motion Field Estimation using MRF

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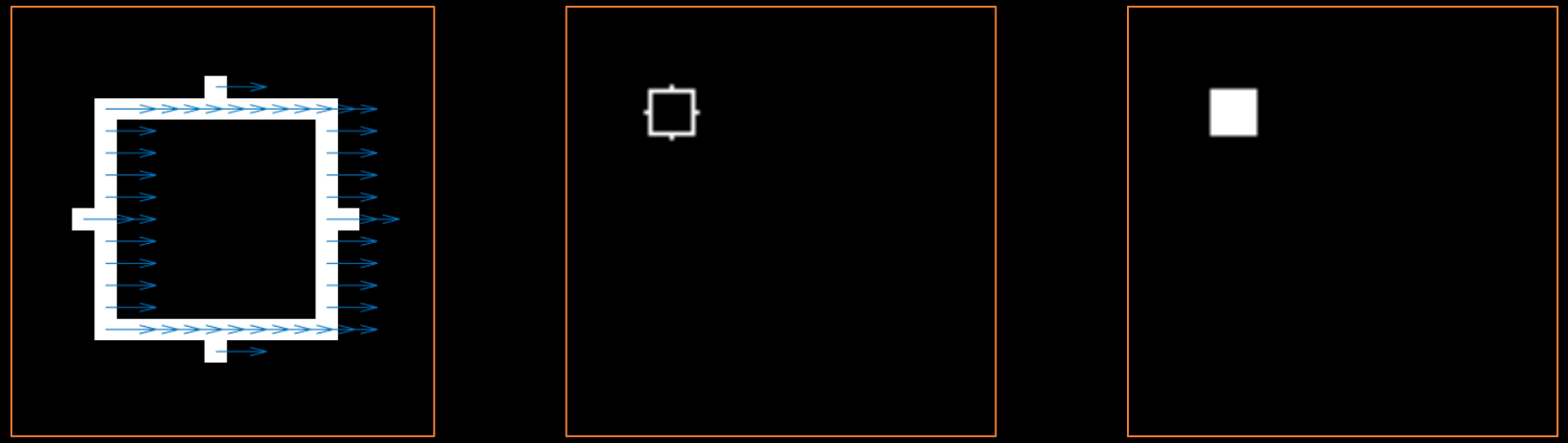
Agenda

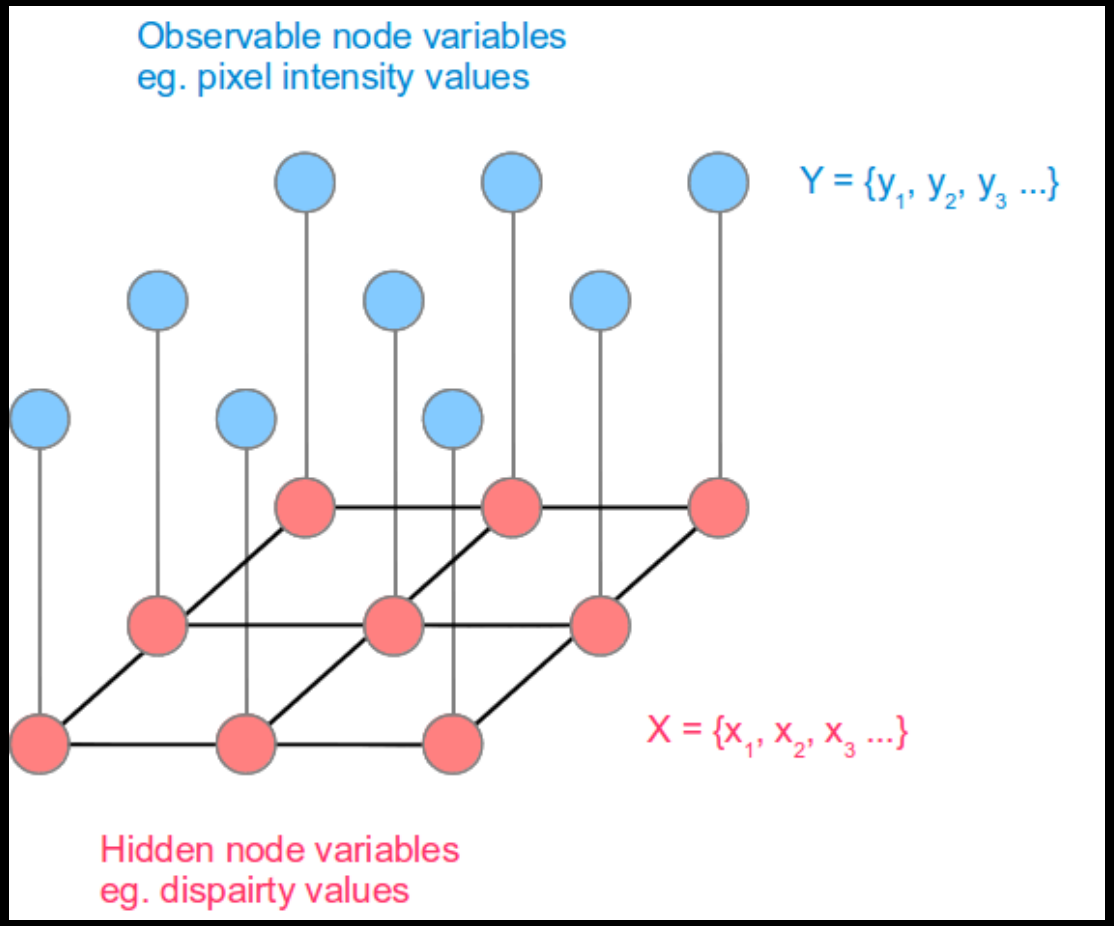
- What is Edge Flow?
- MRF
- Belief Propagation
- Edge Flow using MRF and Belief Propagation
- Tools Used for Edge Flow
- Results on Synthetic Images
- Results on Natural Images

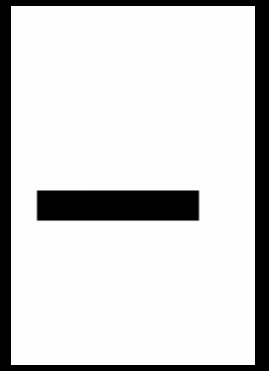
Edge Flow

- Motion of Image edges is called Edge Flow



Markov Random Field





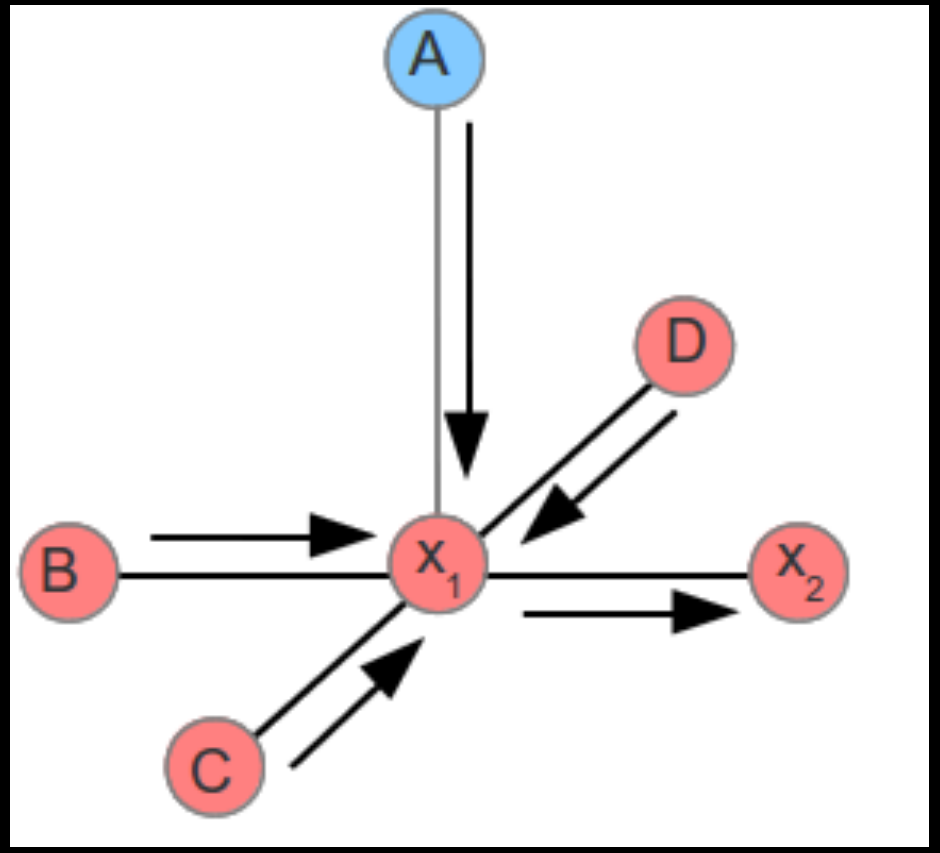
Markov Random Field

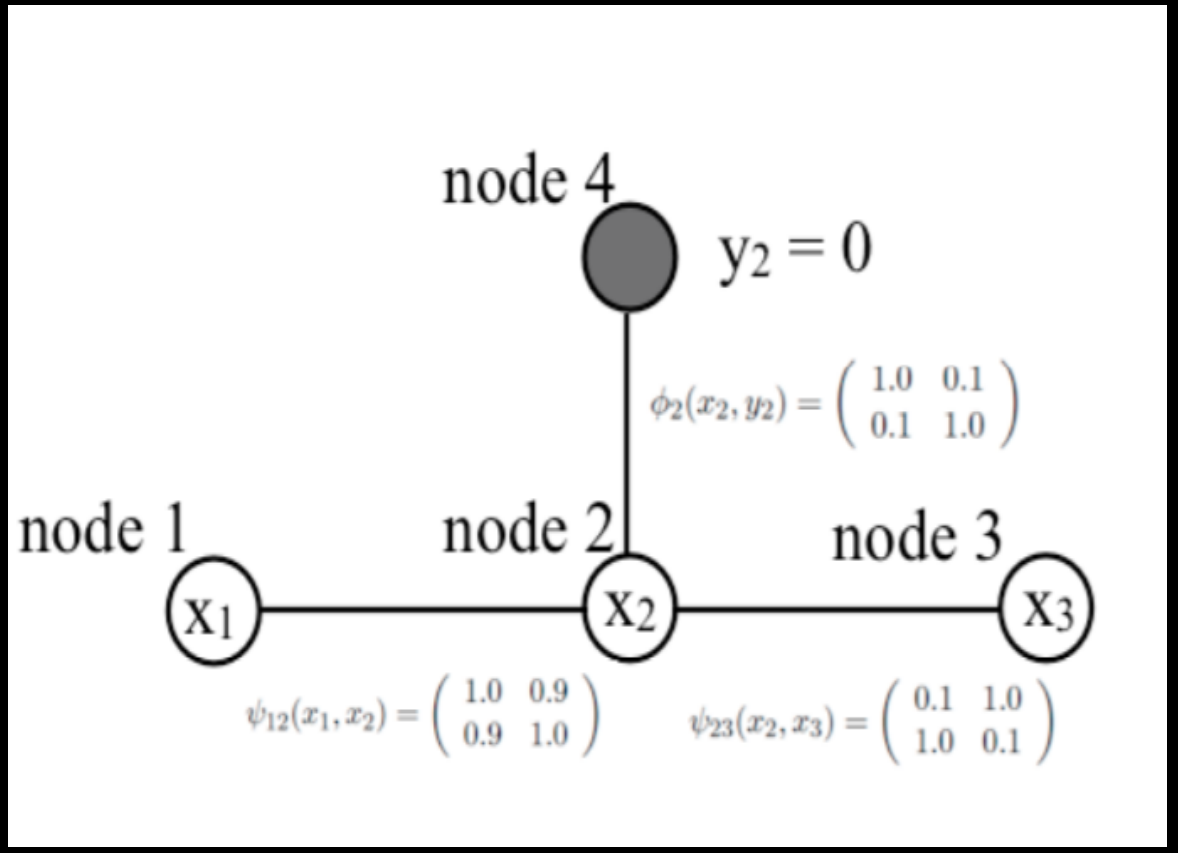
$$P(x_1, x_2, \ldots, x_N) = \frac{1}{Z} f(x_1, x_2) g(x_2) h(x_2, x_3, x_4)$$ *Probability domain*

$$P(x_1, x_2, \ldots, x_N) = \frac{1}{Z} e^{F(x_1,x_2)+G(x_2)+H(x_2,x_3,x_4)}$$ *Energy (log prob.) domain*

$$energy(Y, X) = \sum_i DataCost(y_i, x_i) + \sum_{j=\text{neighbours of i}} SmoothnessCost(x_i, x_j)$$

Belief Propagation





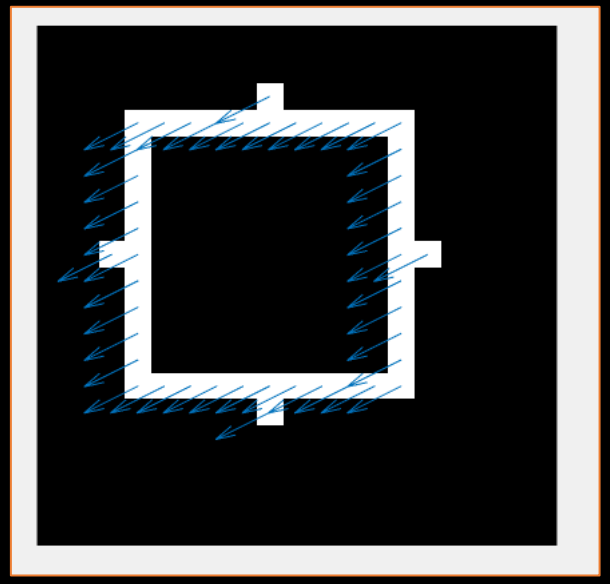
Edge Flow Using MRF & BP

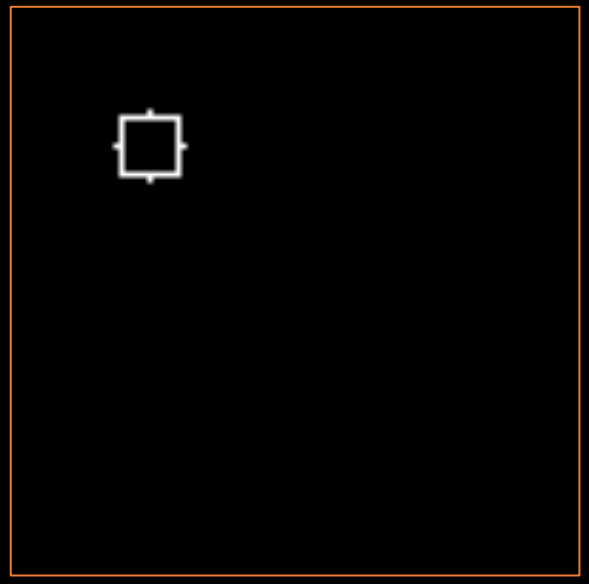
- Data Cost
  - Sum of Squared Differences
- Smoothness Term
  - Dot Product of Velocity Vectors

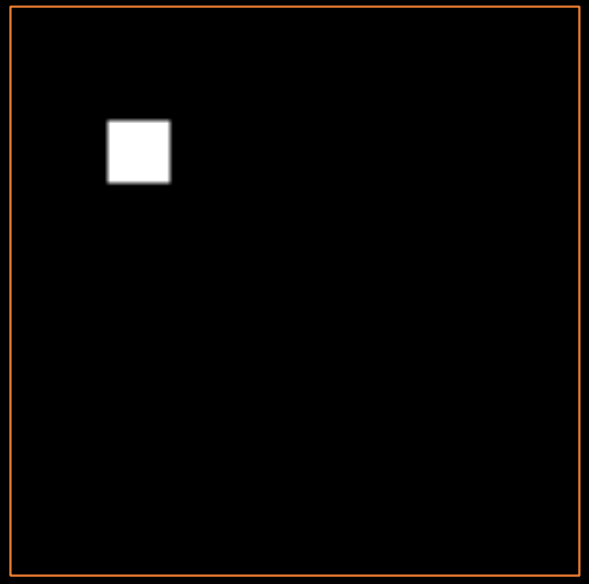
Tools Used

- OpenCV 3.2, 64 Bit
- Matlab 2016b
- Yaml – To Read openCV yml in Matlab

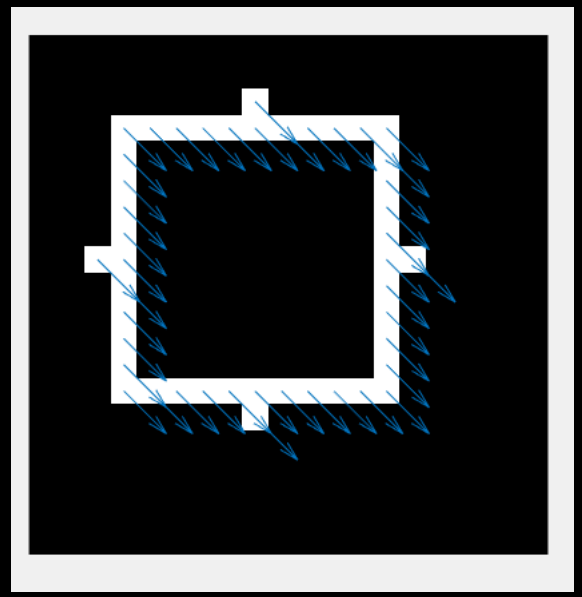
Results on Synthetic Image

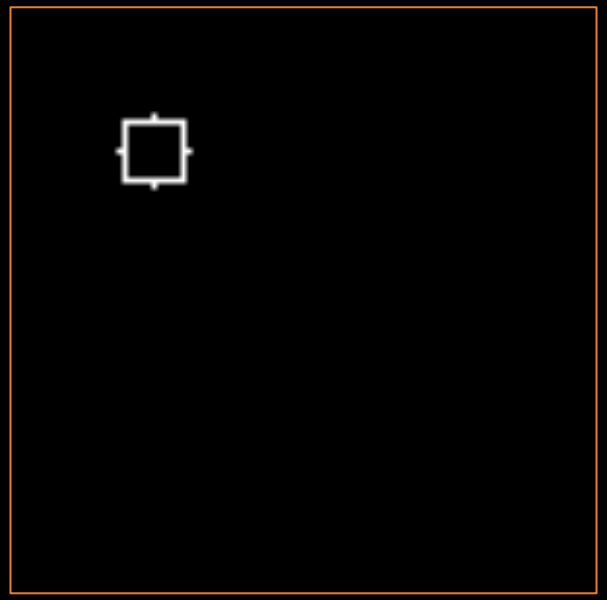


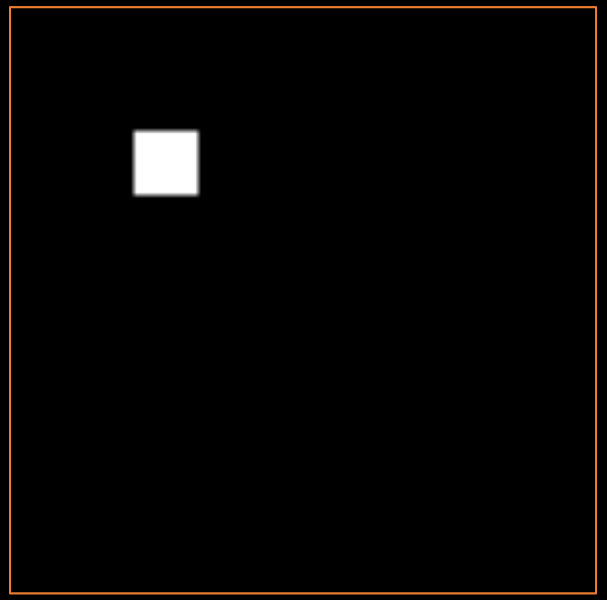




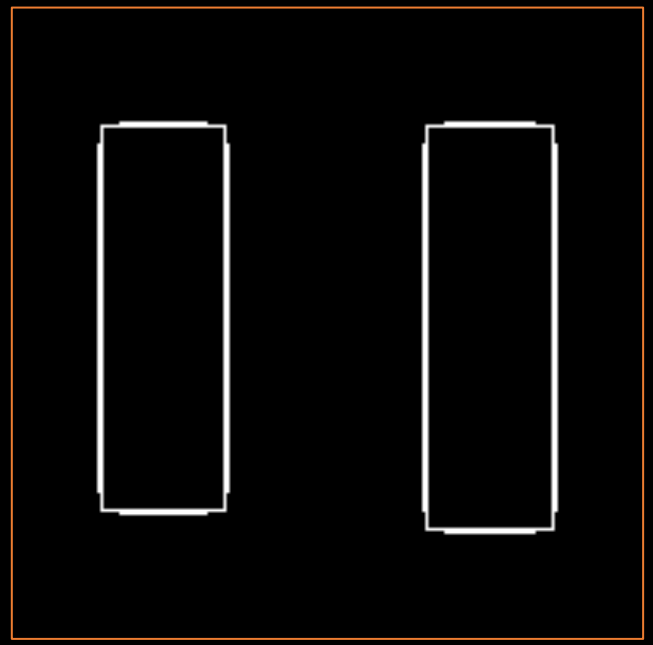
Results on Synthetic Image

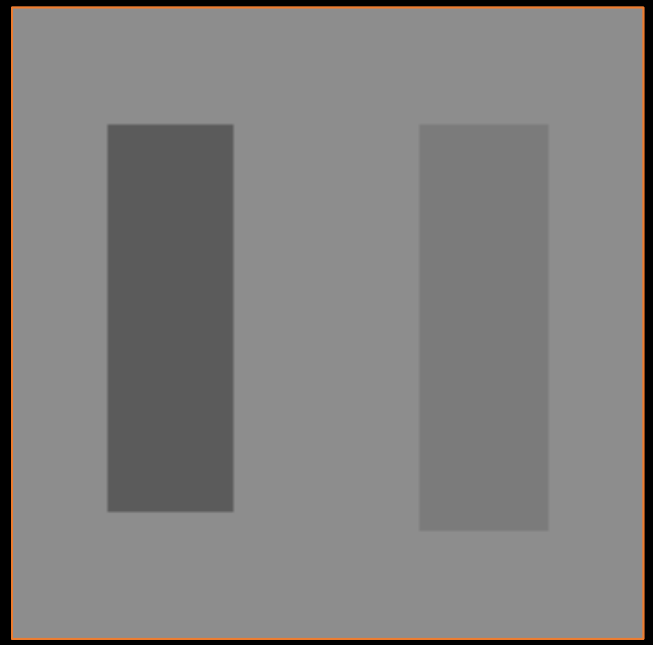


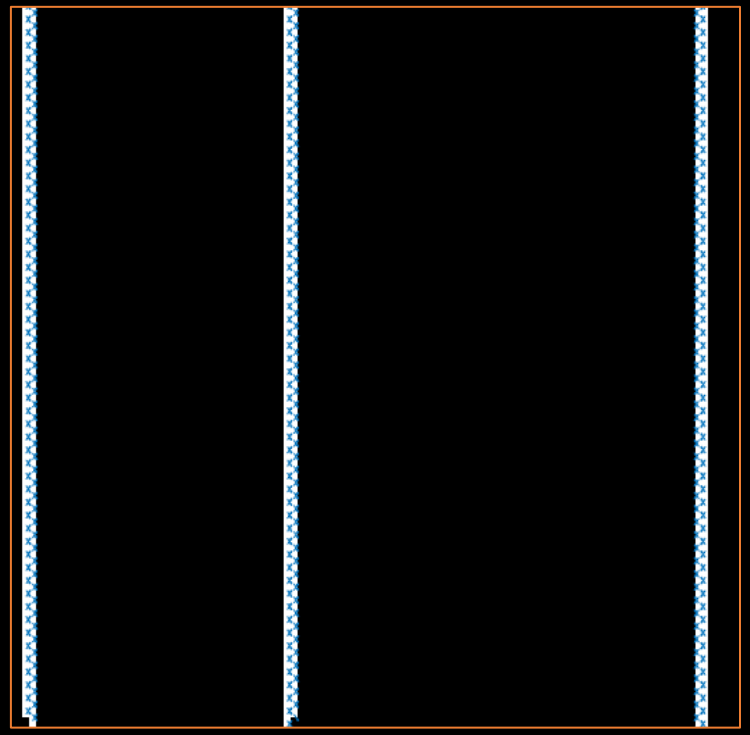




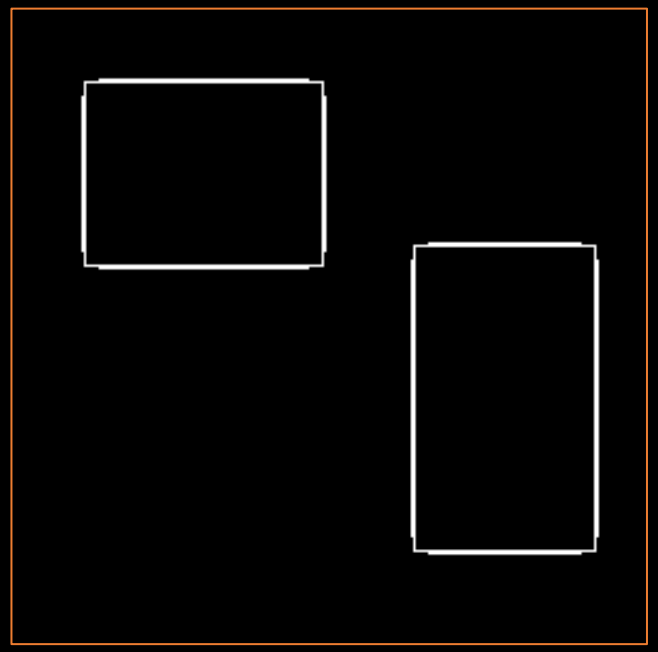
Results on Synthetic Image

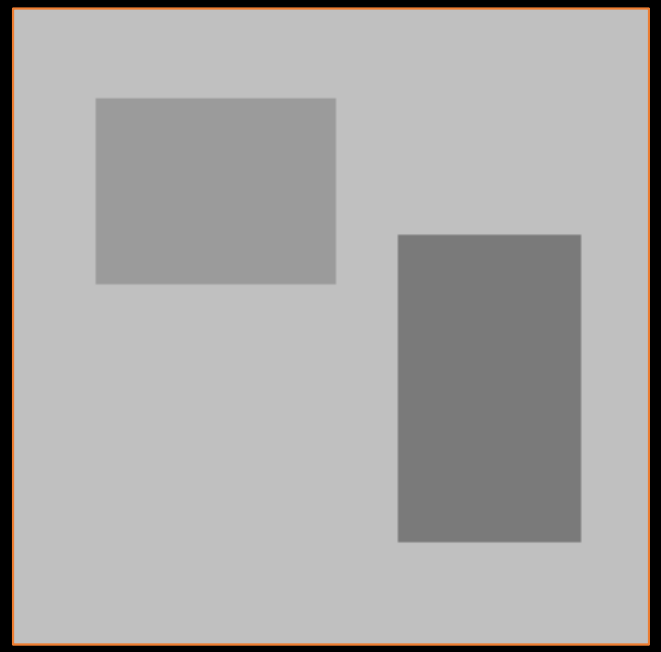


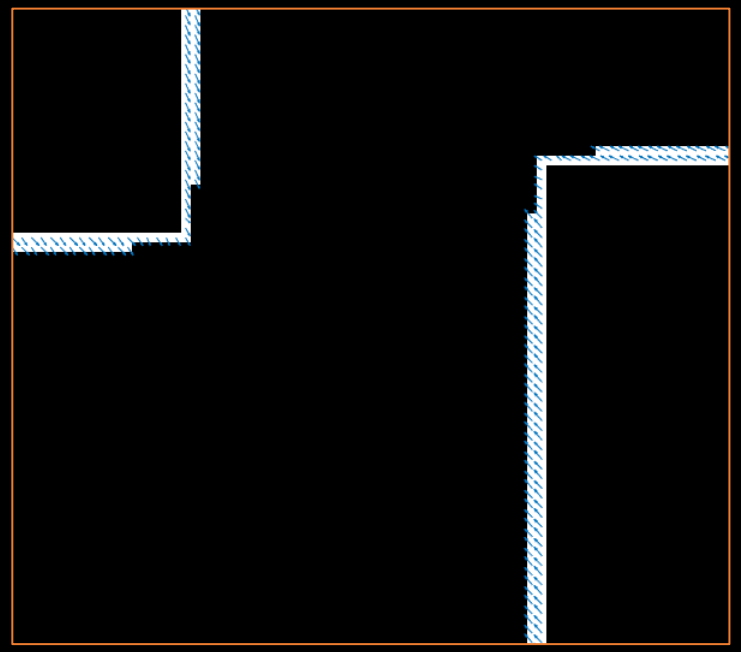




Results on Synthetic Image







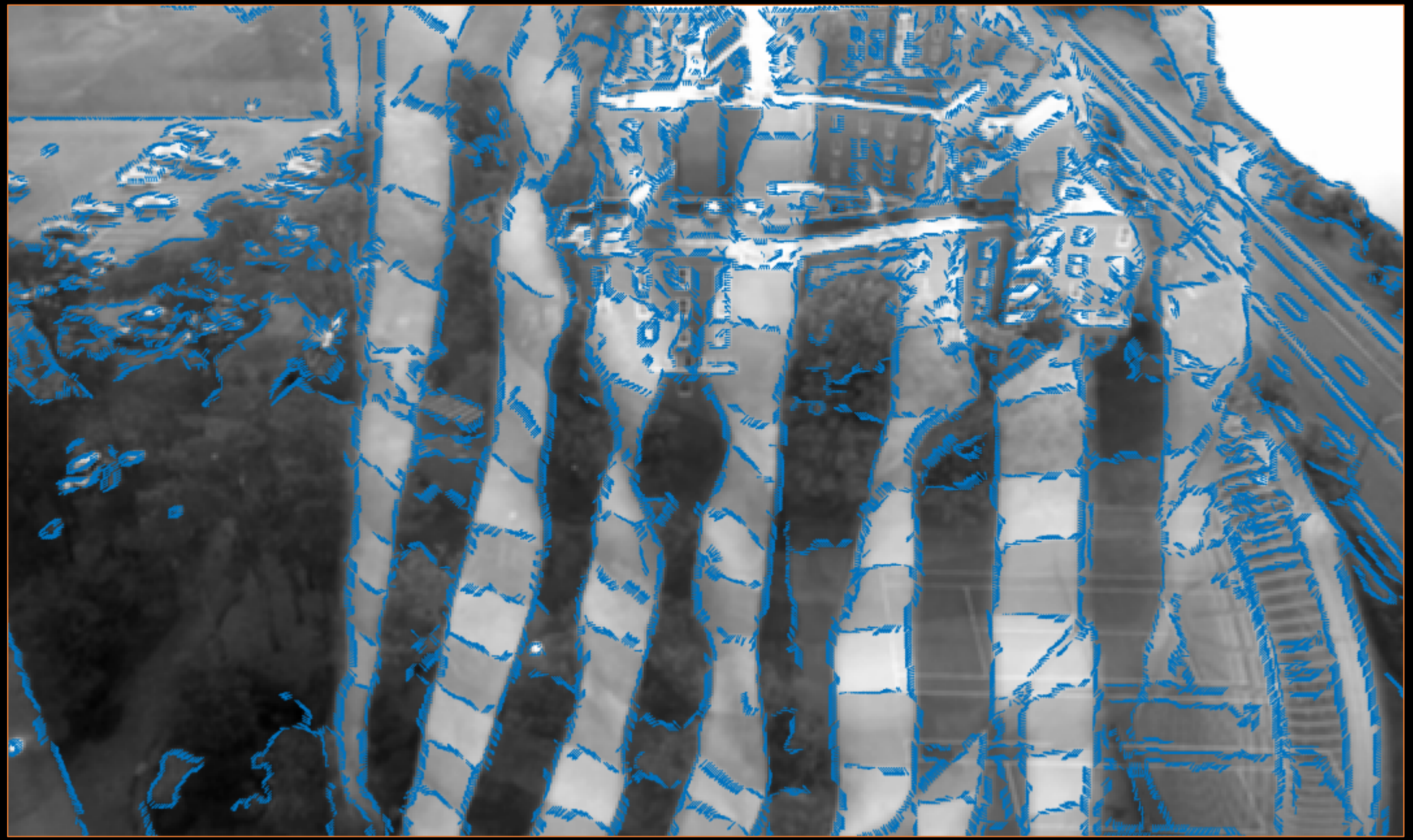
Results on Natural Images

- Stereo Image

Results on Natural Image

Results of Natural Image

Results of Image with Reflections



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- Christopher Bishop MLSS 2013 (https://www.youtube.com/watch?v=c0AWH5UFyOk&t=2931s)