



# *Video Data Fusion Methods*

The Rosenberg Image and Video Processing Lab  
**Professor Leonid P. Yaroslavsky**

**Barak Fishbain**

**Ianir Ideses**

Department of Electrical Engineering Physical Electronics

The Iby & Aldar Fleischman - Faculty of Engineering

Tel-Aviv University

---



Tel-Aviv University

The Iby & Aldar Fleischman - Faculty of Engineering

Department of Electrical Engineering – Physical Electronics

Rosenberg Digital Image Processing & Remote Sensing Lab

# *Video Stabilization with Real Motion Preservation*



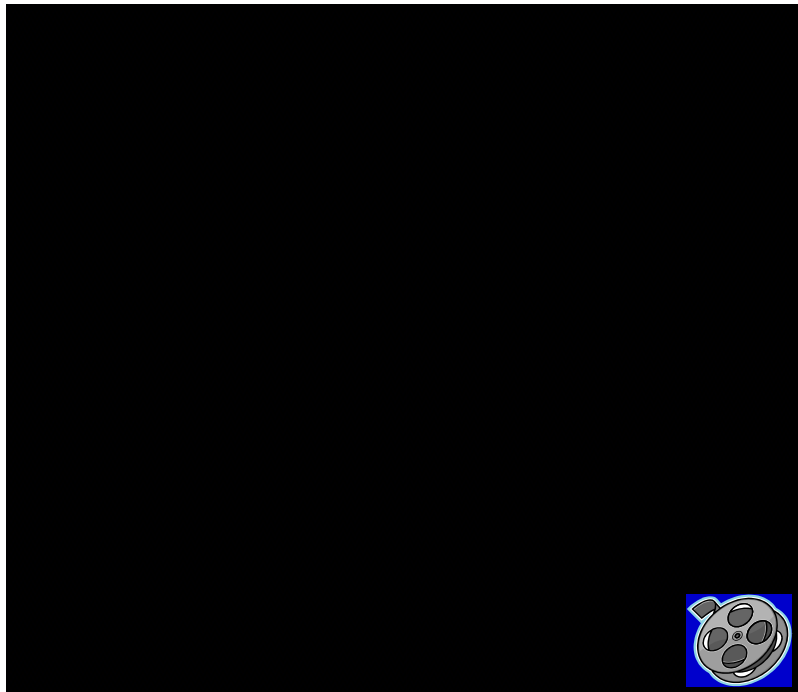
Click to Play







# *Video Stabilization with Real Motion Preservation*





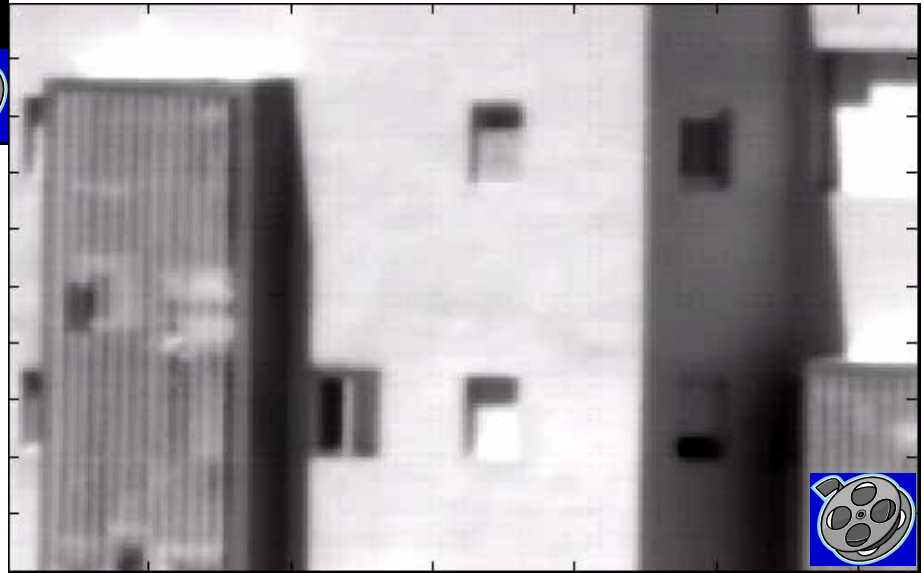
Tel-Aviv University

The Iby & Aldar Fleischman - Faculty of Engineering

Department of Electrical Engineering – Physical Electronics

Rosenberg Digital Image Processing & Remote Sensing Lab

## *Video Stabilization with Real Motion Preservation*



B. Fishbain, L. P. Yaroslavsky and I. A. Ideses, "Real-time stabilization of long range observation system turbulent video", Journal of Real-Time Image Processing Vol.2(1), pp. 11-22, Oct. 2007.



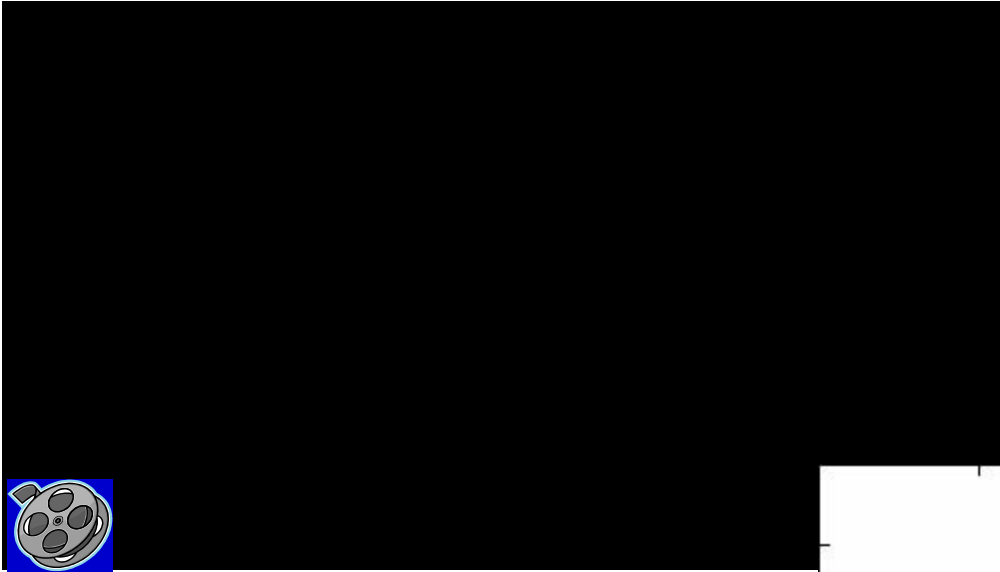
Tel-Aviv University

The Iby & Aldar Fleischman - Faculty of Engineering

Department of Electrical Engineering – Physical Electronics

Rosenberg Digital Image Processing & Remote Sensing Lab

# *Video Stabilization with Real Motion Preservation*



L.P. Yaroslavsky, B. Fishbain, I. Ideses, D. Slasky, Z. Hadas, “Simple methods for real time stabilization of turbulent video”, ICO Topical Meeting on, Optoinformatics, Saint-Petersburg, Russia, 4-7 September 2006.



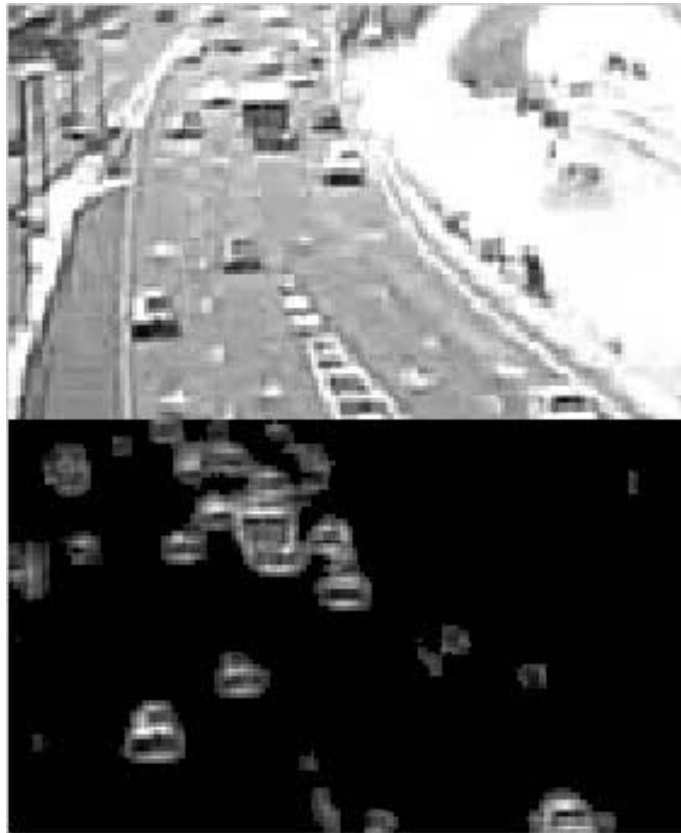
Tel-Aviv University

The Iby & Aldar Fleischman - Faculty of Engineering

Department of Electrical Engineering – Physical Electronics

Rosenberg Digital Image Processing & Remote Sensing Lab

# *Real-time Real-Motion Extraction (Traffic Scenarios)*





Tel-Aviv University

The Iby & Aldar Fleischman - Faculty of Engineering

Department of Electrical Engineering – Physical Electronics

Rosenberg Digital Image Processing & Remote Sensing Lab

# *Real-time Real-Motion Extraction (Traffic Scenarios)*





# Super-Resolution

Unfortunately, when  $s$  is noisy, how is  $g$  related to  $f$ ? To furnish an estimate,  $\hat{f}$ , by noise, does the noise rate the effects of the  $g$  in  $f$ ? Even if  $g$  is computed from  $\hat{f}$ ? What is fully incorporated in

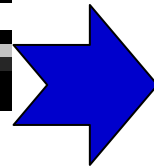
Unfortunately, when  $s$  is noisy, how is  $g$  related to  $f$ ? To furnish an estimate,  $\hat{f}$ , by noise, does the noise rate the effects of the  $g$  in  $f$ ? Even if  $g$  is computed from  $\hat{f}$ ? What is fully incorporated in





## *Super-Resolution from Turbulent Videos*

Unfortunately, when slow motion is related to  $f$ ?  
to furnish an estimate, by noise, does the noise rate the effects of the changes in  $f$ ? Even if  $g$  is outputting  $\hat{f}$  from  $g$ ? What is fully incorporated in



Unfortunately, when slow motion is related to  $f$ ?  
to furnish an estimate, by noise, does the noise rate the effects of the changes in  $f$ ? Even if  $g$  is outputting  $\hat{f}$  from  $g$ ? What is fully incorporated in



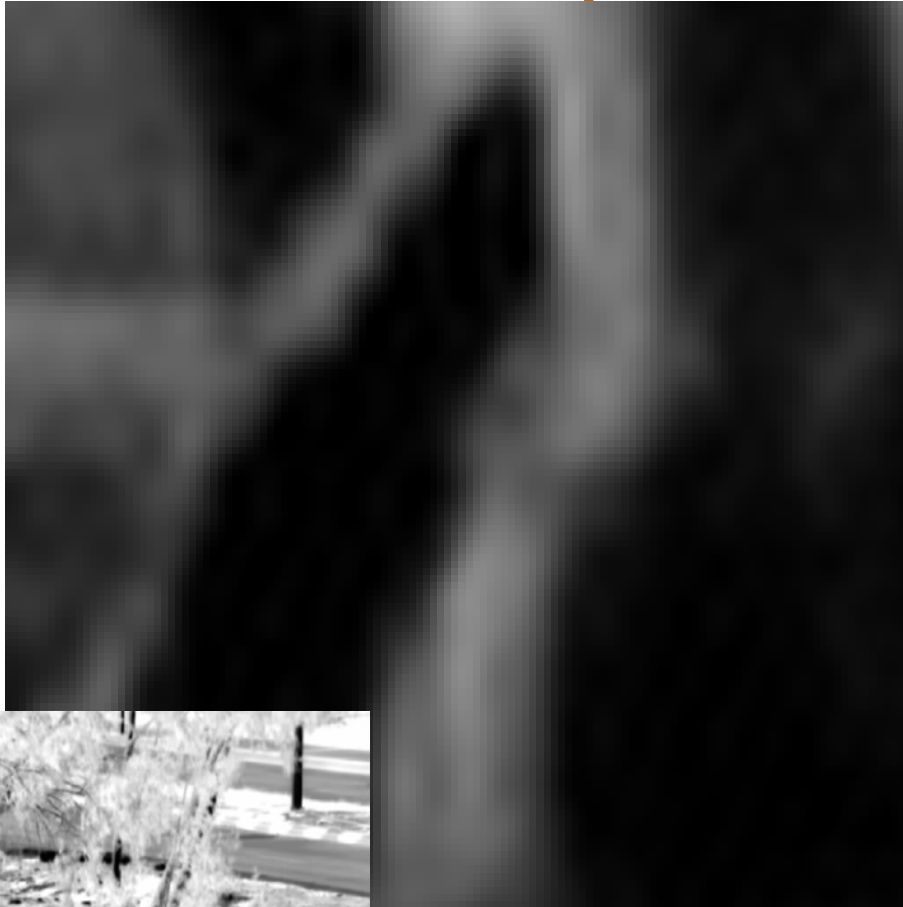
Tel-Aviv University

The Iby & Aldar Fleischman - Faculty of Engineering

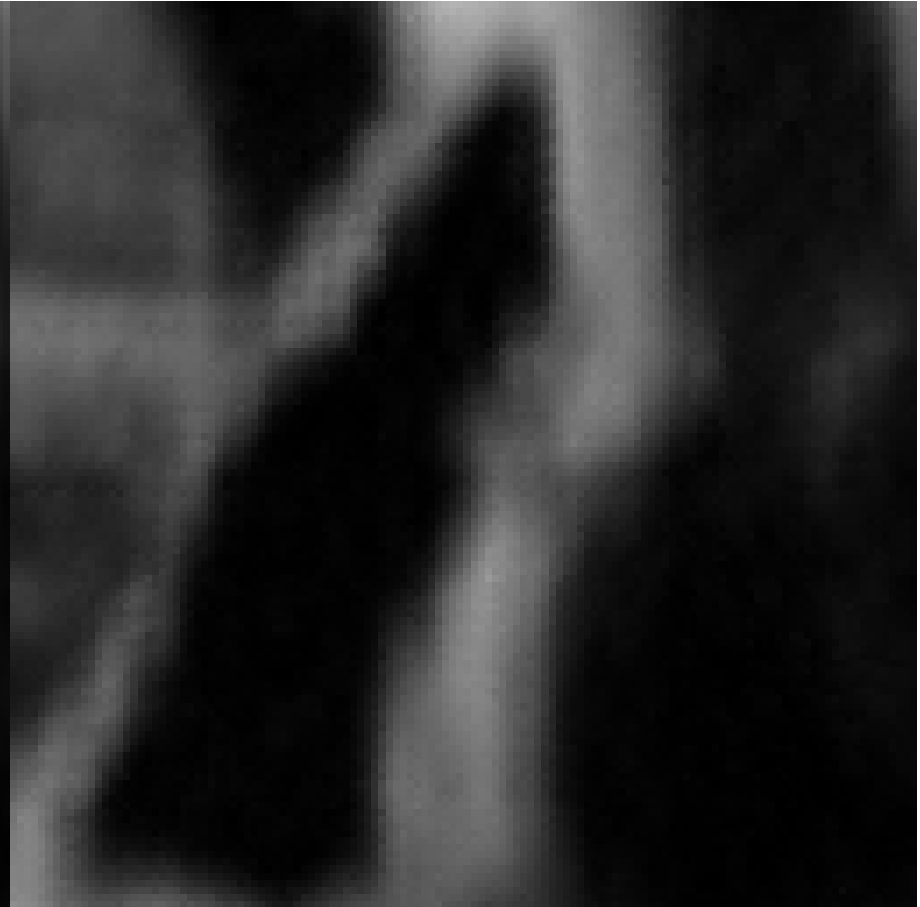
Department of Electrical Engineering – Physical Electronics

Rosenberg Digital Image Processing & Remote Sensing Lab

# *Results – Super Resolved Frames*



Interpolated Image



Super-resolved Image





Tel-Aviv University

The Iby & Aldar Fleischman - Faculty of Engineering

Department of Electrical Engineering – Physical Electronics

Rosenberg Digital Image Processing & Remote Sensing Lab

# *Results – Super Resolved Frames*



Interpolated Image

Super-resolved Image





Tel-Aviv University

The Iby & Aldar Fleischman - Faculty of Engineering

Department of Electrical Engineering – Physical Electronics

Rosenberg Digital Image Processing & Remote Sensing Lab

# *Super Resolution - Consumer Electronics Applications*



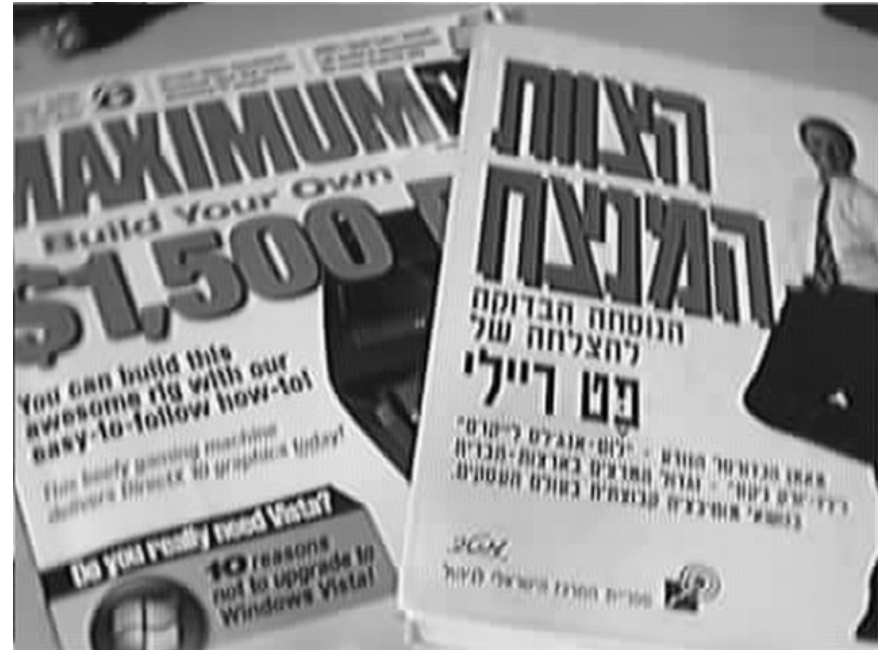
Handheld Webcam Video



# *Super Resolution - Consumer Electronics Applications*



Interpolated Image



Super-resolved Image

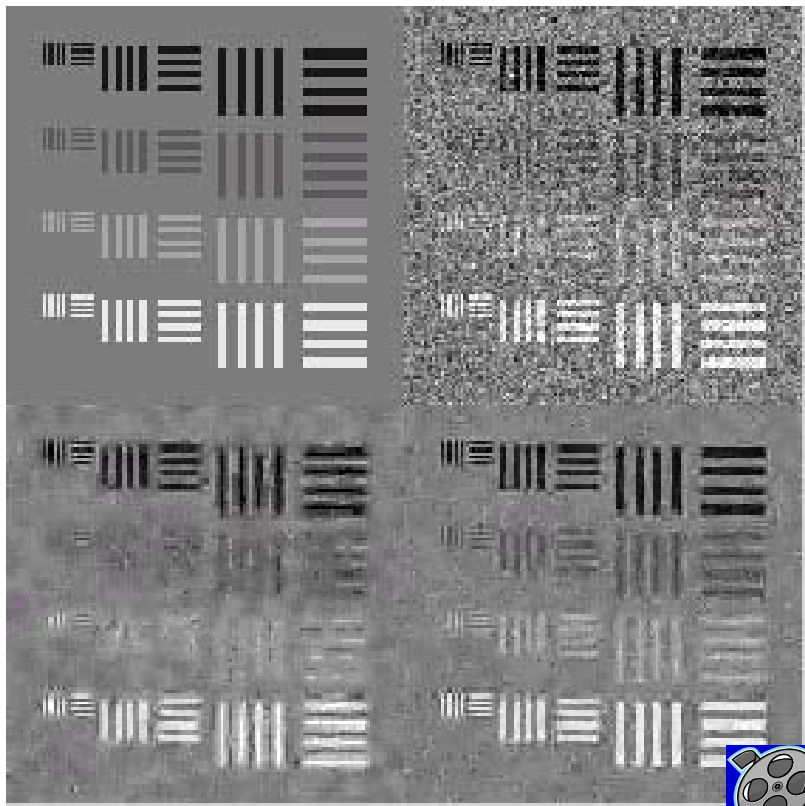


# 3D (Spatial-Temporal) Noise Filtering

## Simulated video sequences

ideal

noisy



2-D

3-D

ideal

noisy



2-D

3-D



# *3D (Spatial-Temporal) Noise Filtering*

## ⊕ Real Thermal video sequence



Noisy video

Processed video with blind  
deblurring



# *3D (Spatial- Temporal) Noise Filtering*

Filtered Sequence



Original Sequence