

Image and Video Visualization

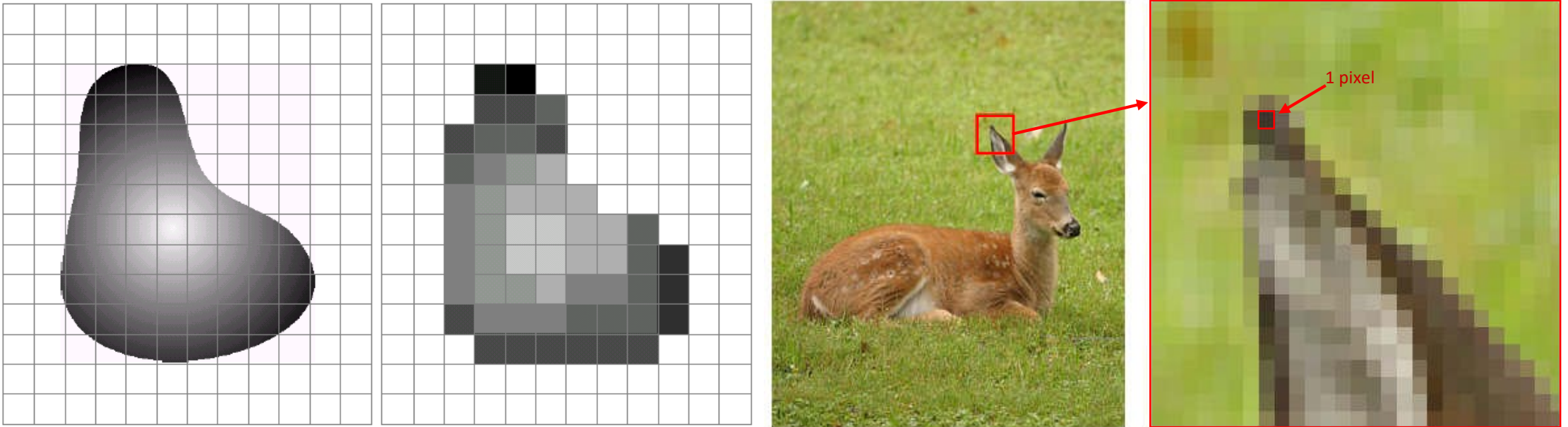
CPS 563 – Data Visualization

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Digital Images

- A **digital image** is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels.



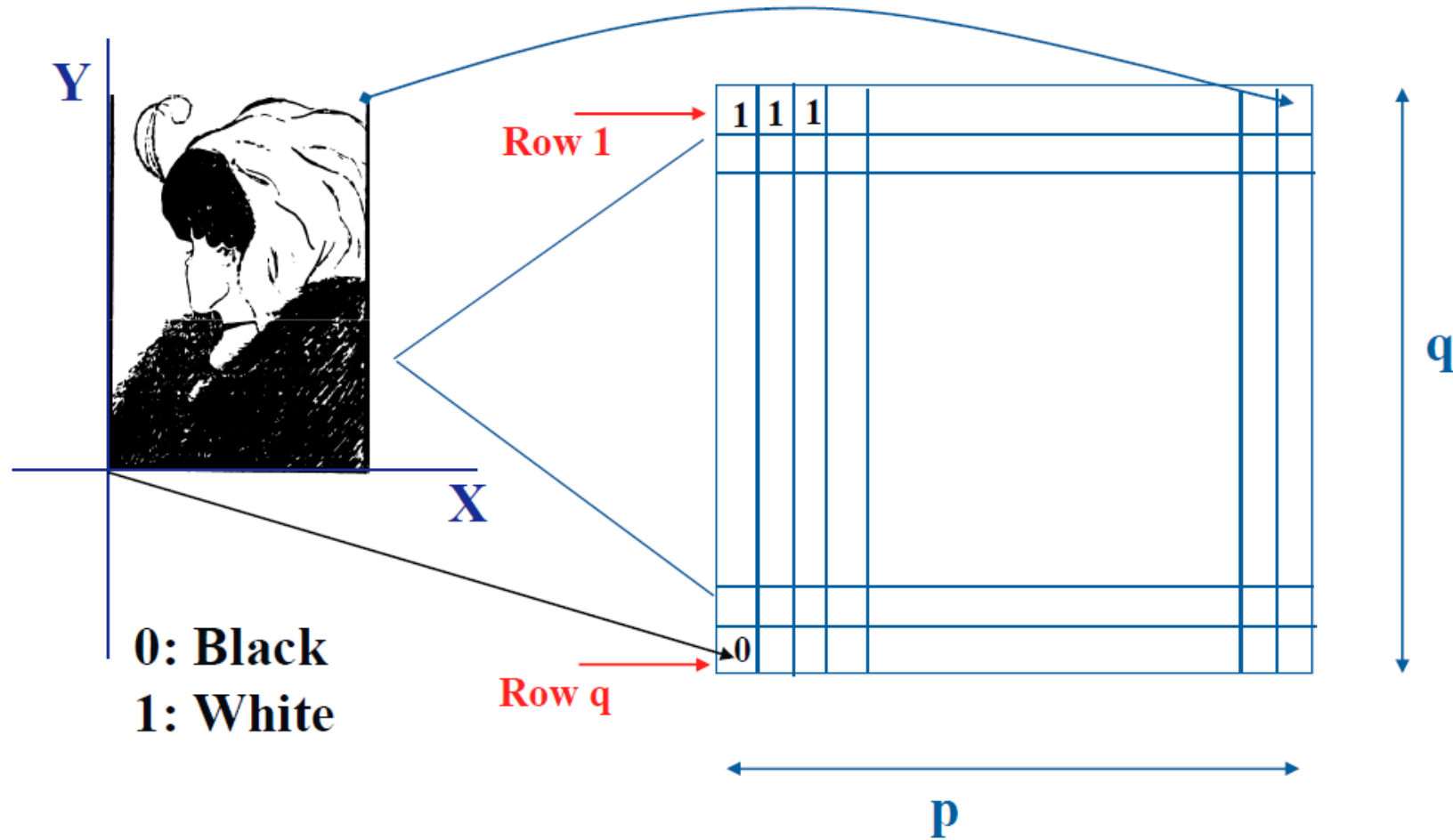
Digitization implies that a digital image is an *approximation* of a real scene.

Image Formats

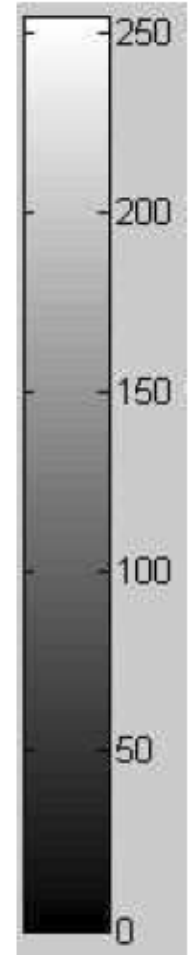
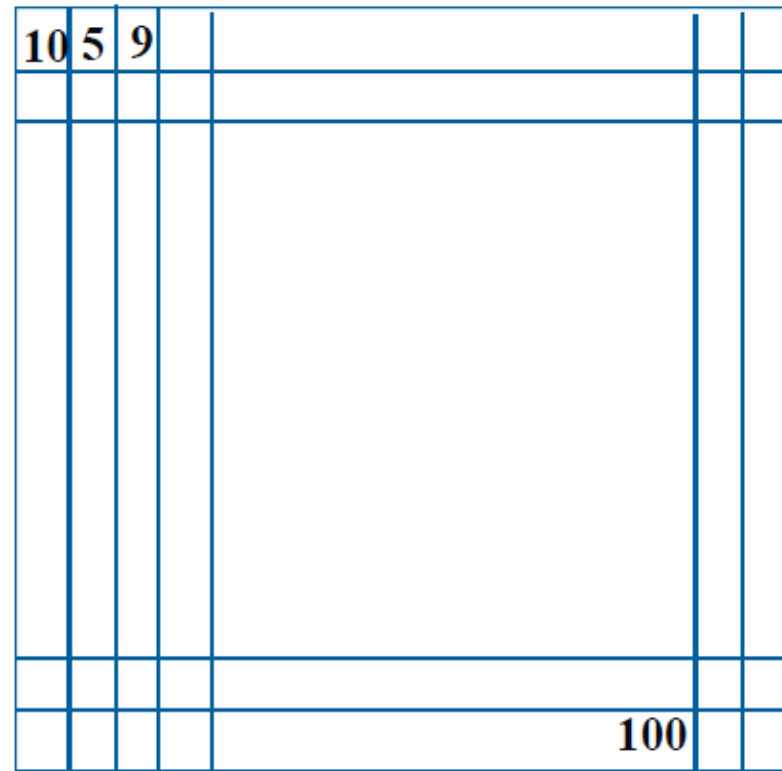
- Common image formats include:
 - 1 sample per pixel (B&W or Grayscale)
 - 3 samples per pixel (Red, Green, and Blue)



Binary Image



Grayscale Image



Color Image (RGB)

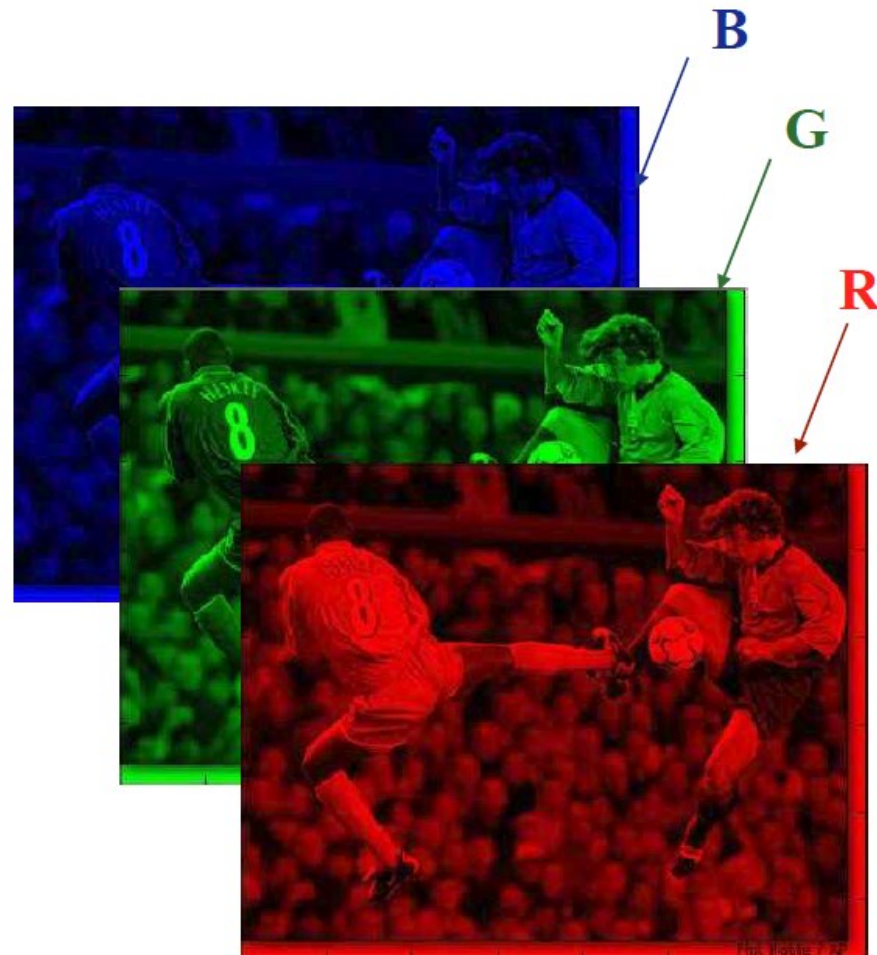
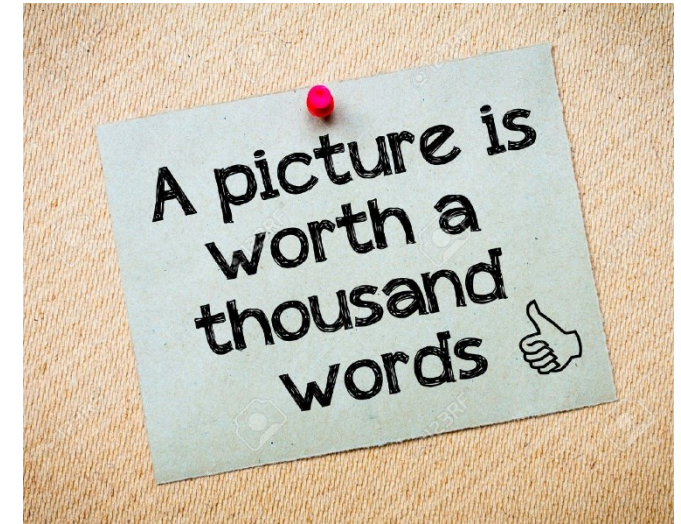


Image Processing and Visualization

- Image processing attempts to enhance the quality of the image.



Deblurring
result



- Image itself can be used for visualization.

Histogram

- A **histogram** is a graphical representation of the distribution of numerical data

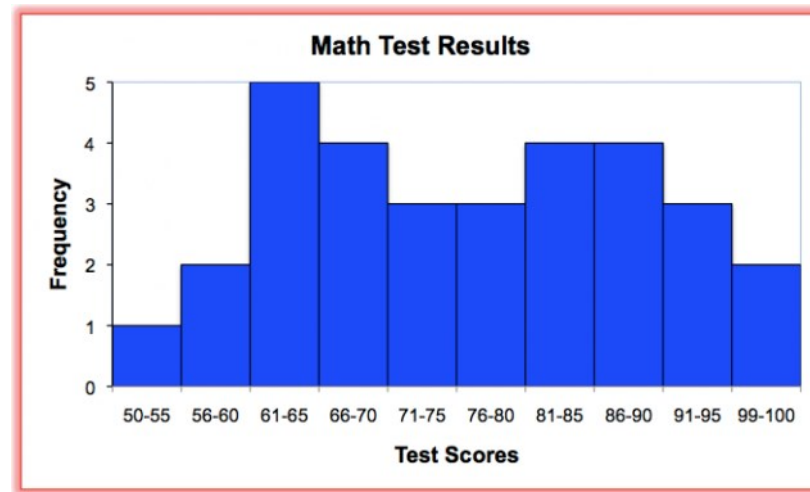
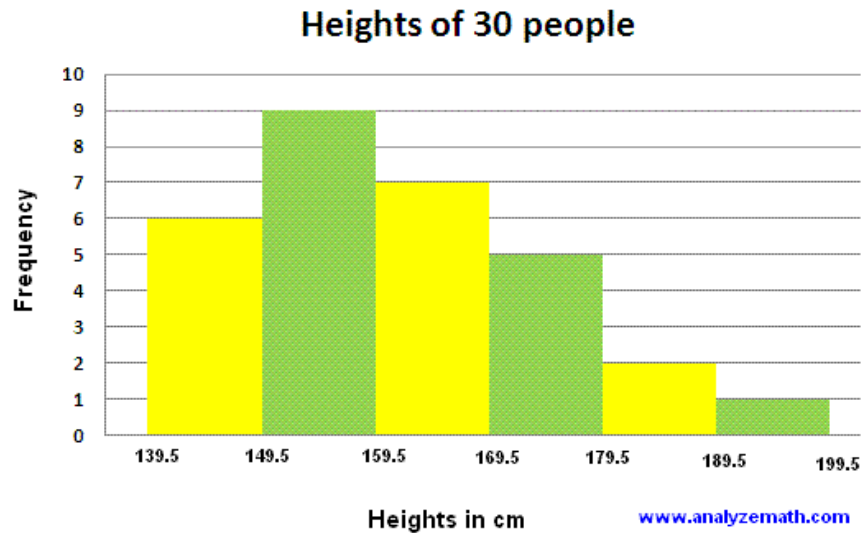


Image Histogram of a gray scale image

- $p(r_k)$ is the “probability” of the occurrence of gray-level r_k
- Histogram provides a global description of the appearance of the image.

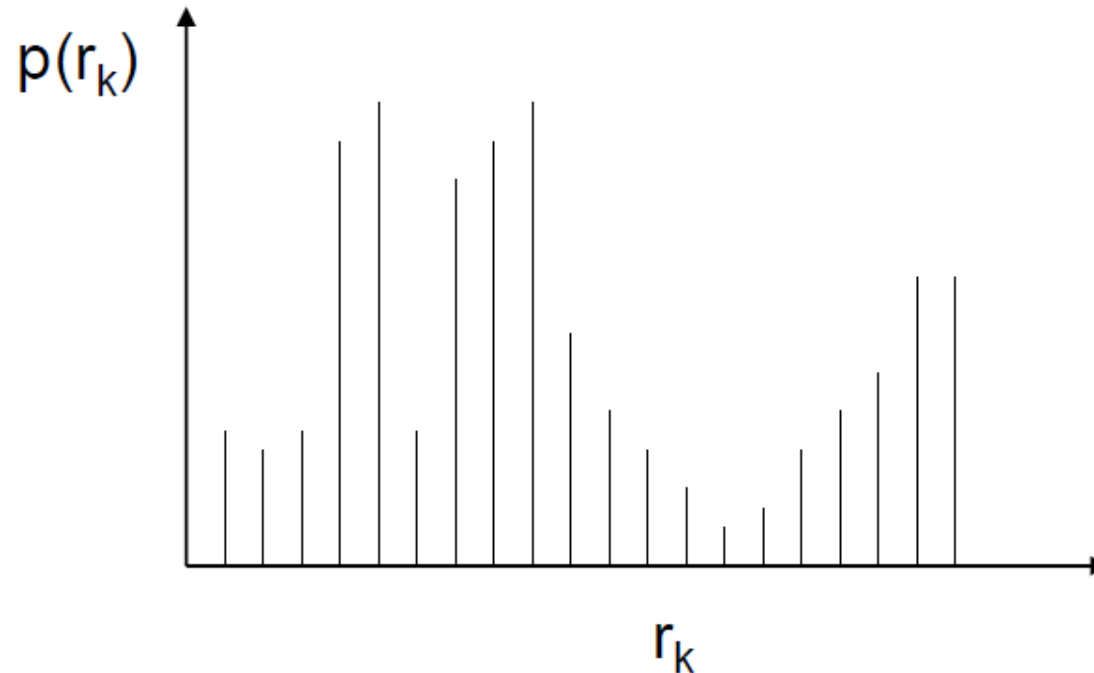
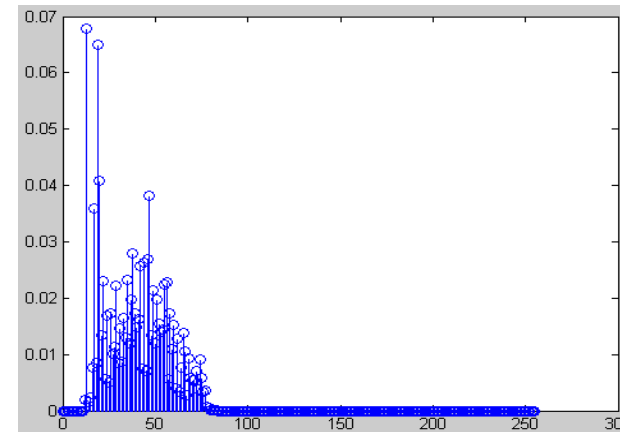
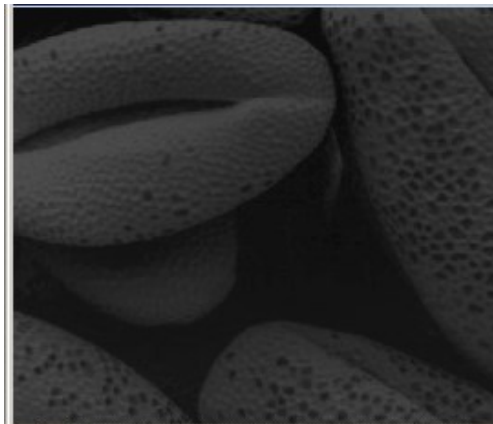


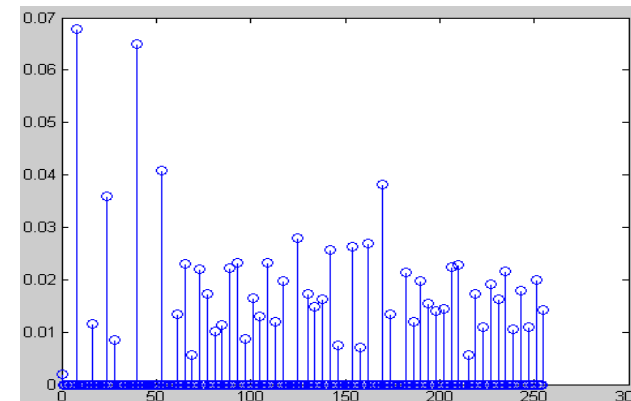
Image Processing – Visualization Examples

- Histogram Equalization

Original image



Modified image



The images themselves can do the visualization



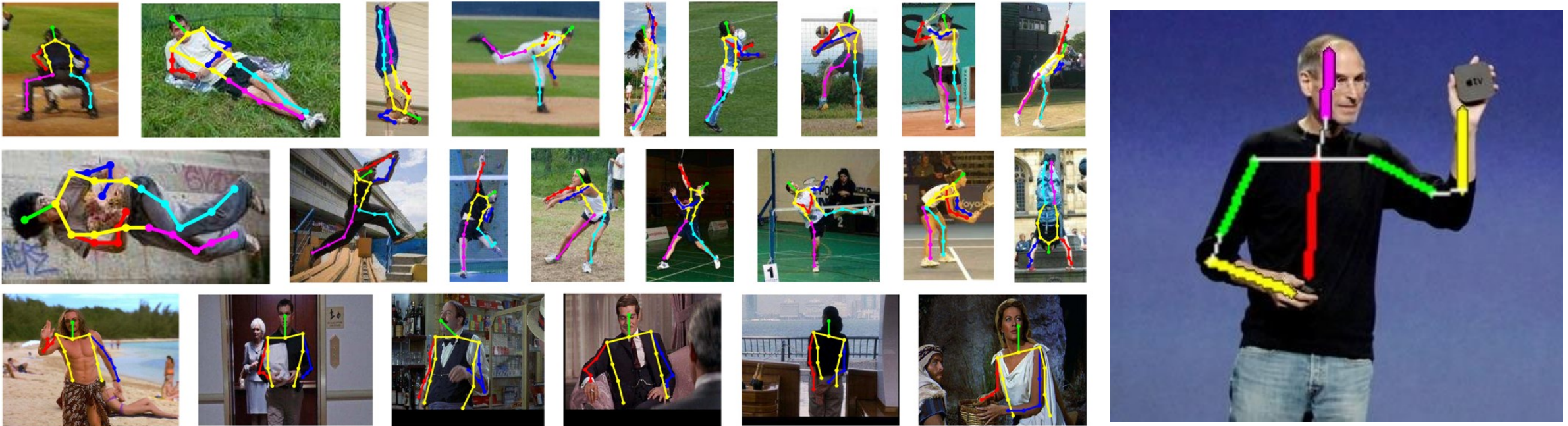
Original image



Modified image

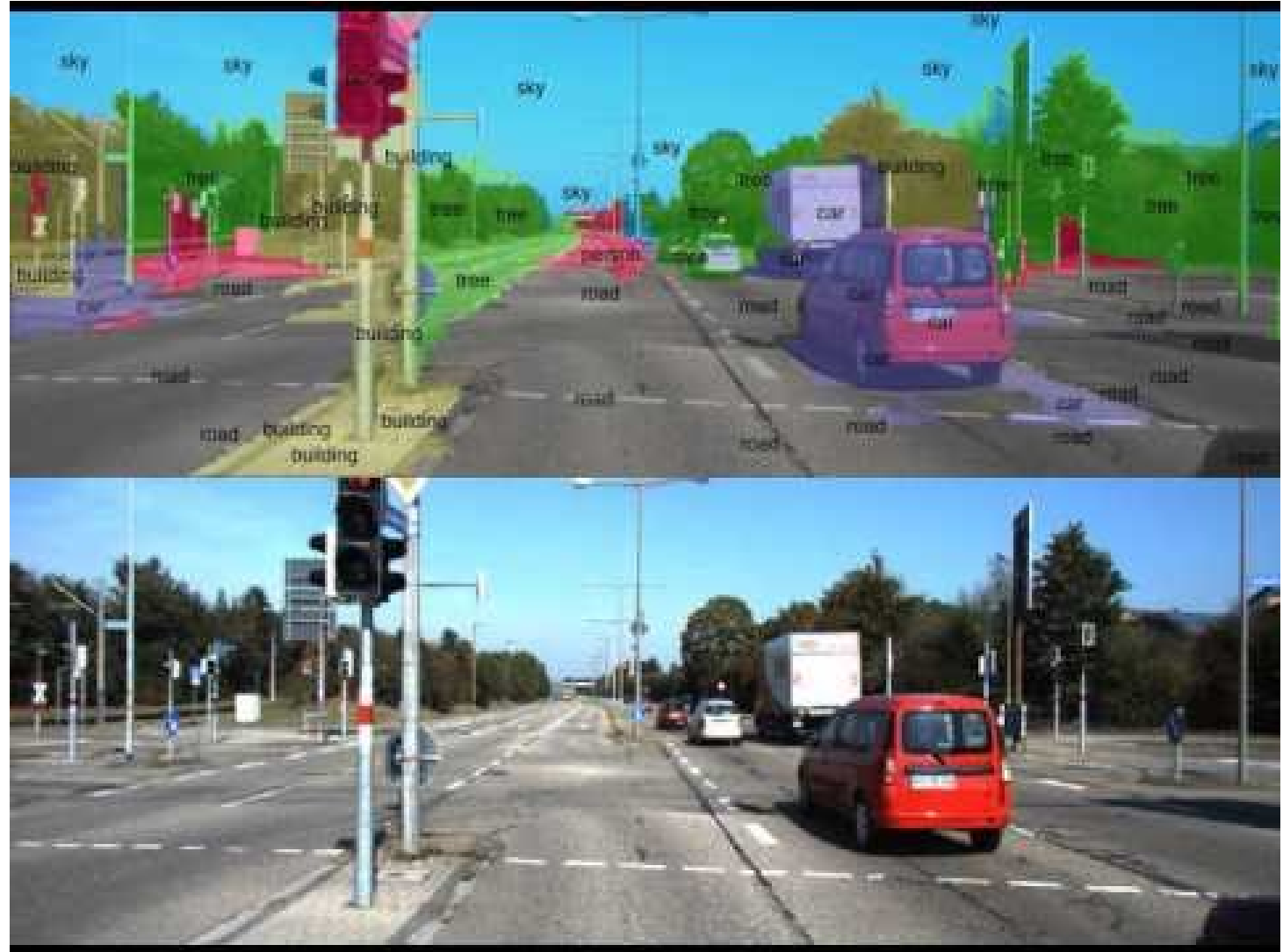
Advanced Computer Vision techniques can be used

- Human pose estimation



Advanced Computer Vision techniques can be used

- Scene Parsing

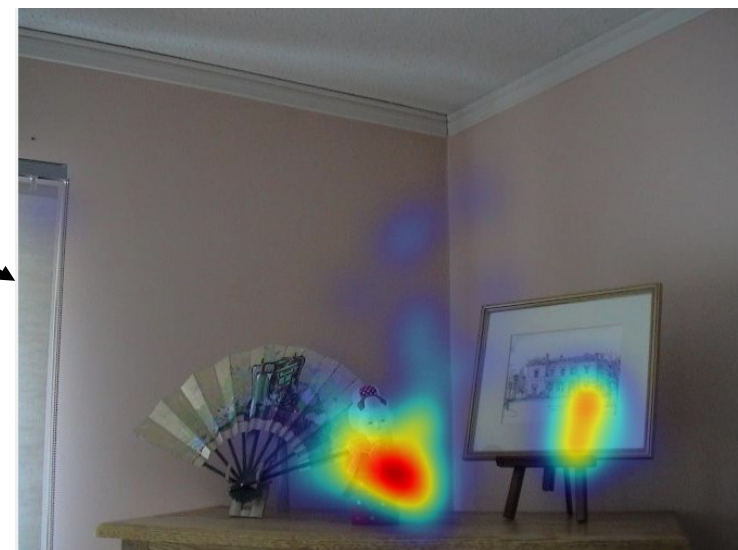


Insights with image visualization

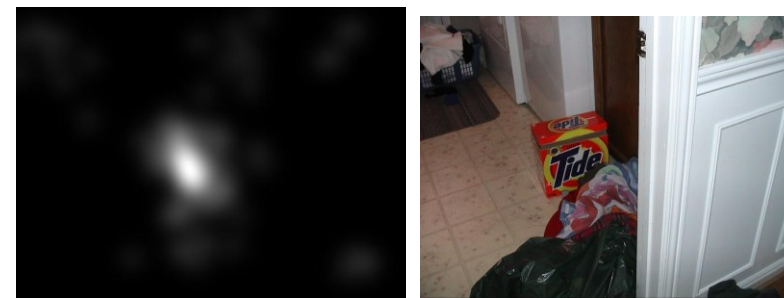
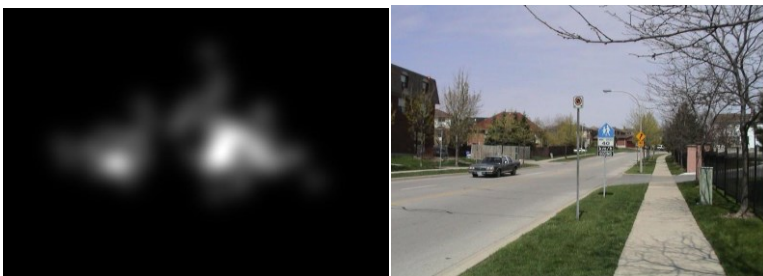
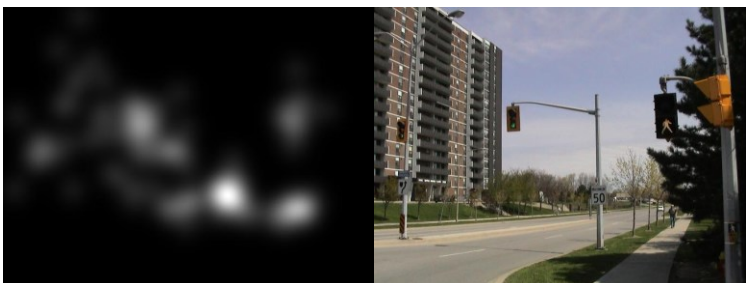
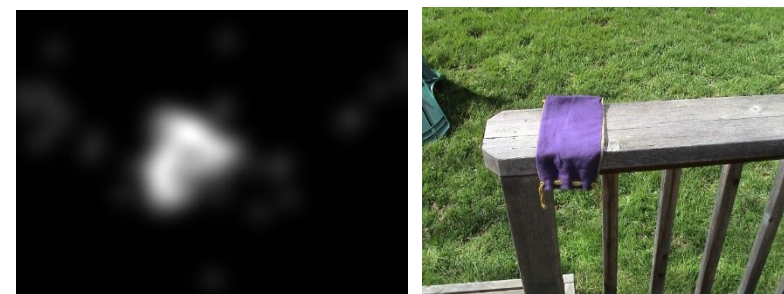
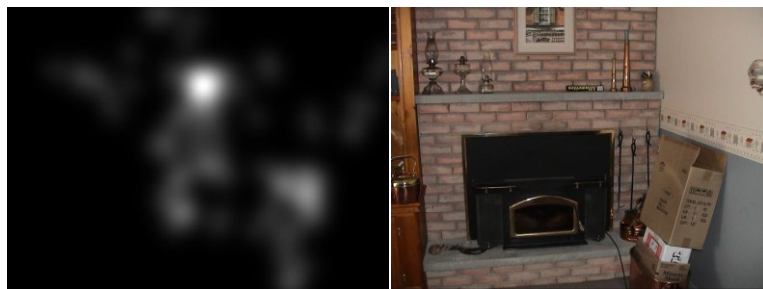
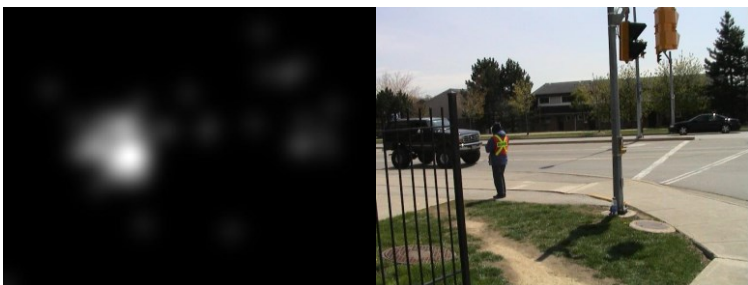


Who is this lady?

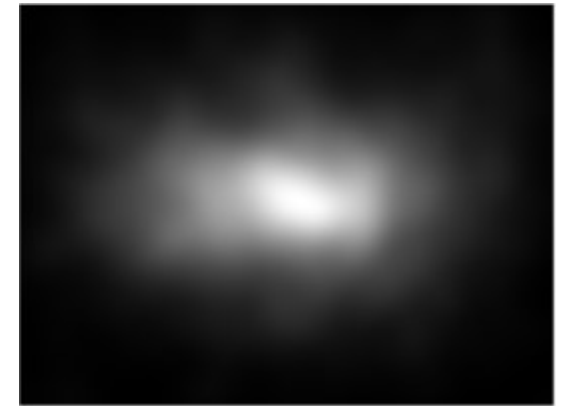
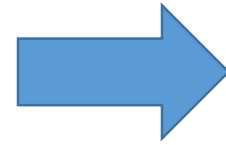
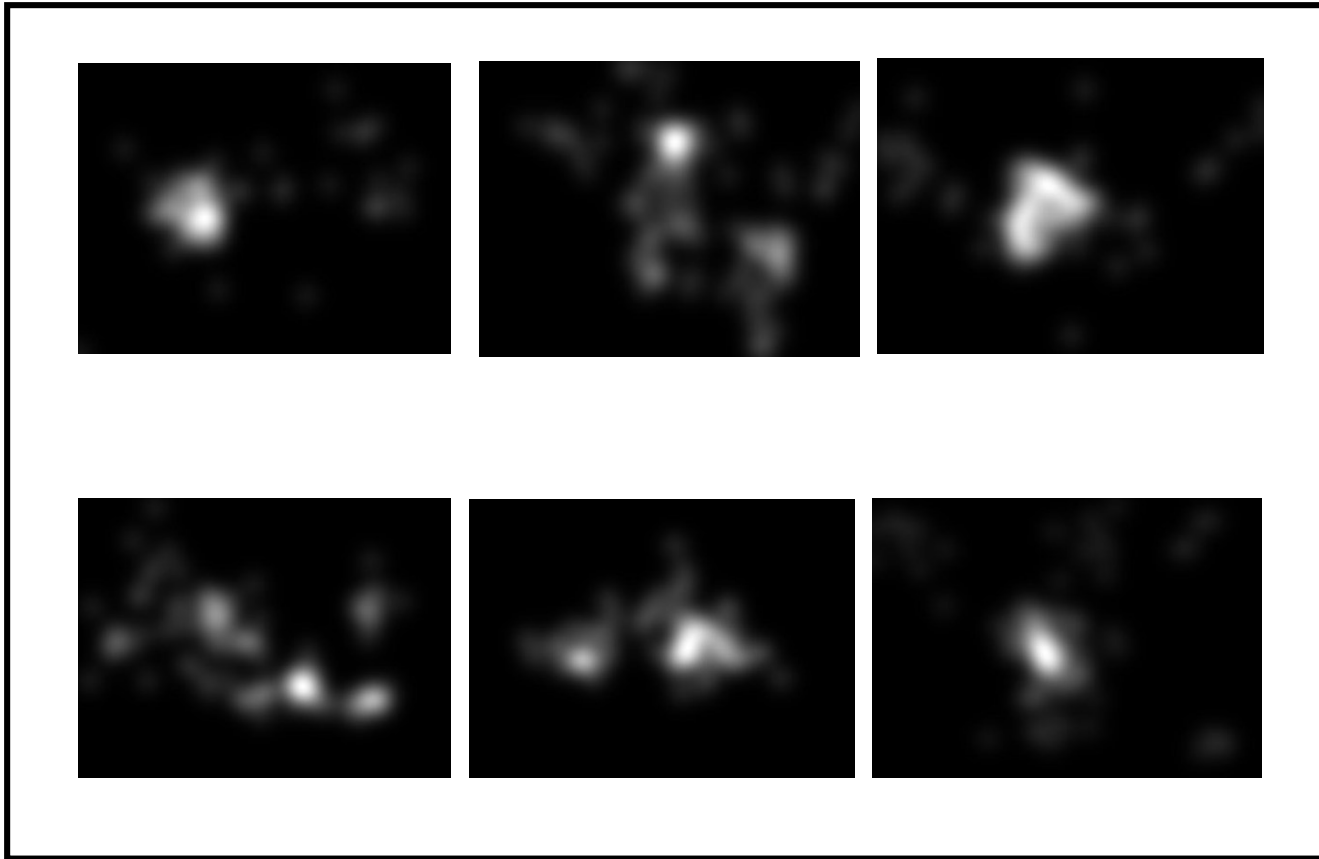
Insights with image visualization



Insights with image visualization



Insights with image visualization



Central bias

Video

- Video tends to be a complex data type when it comes to visualization.
- There is a clear demand for more automatic processing capabilities as there is so much video material captured nowadays making manual processing impossible.

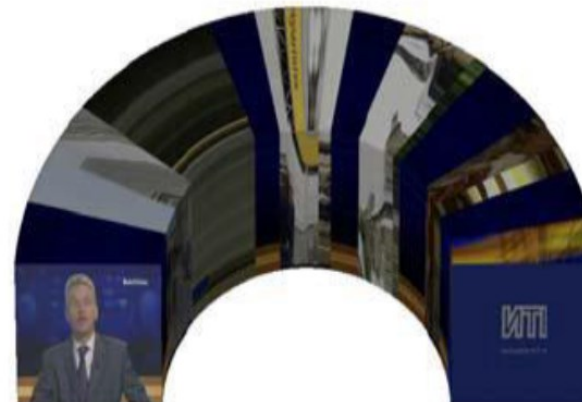


Video Visualization

- Pipeline: *video capture* \Rightarrow *data communication* \Rightarrow *data management* \Rightarrow *video processing* \Rightarrow *video visualization*
- Main concept: use volume visualization techniques for providing overview of entire video

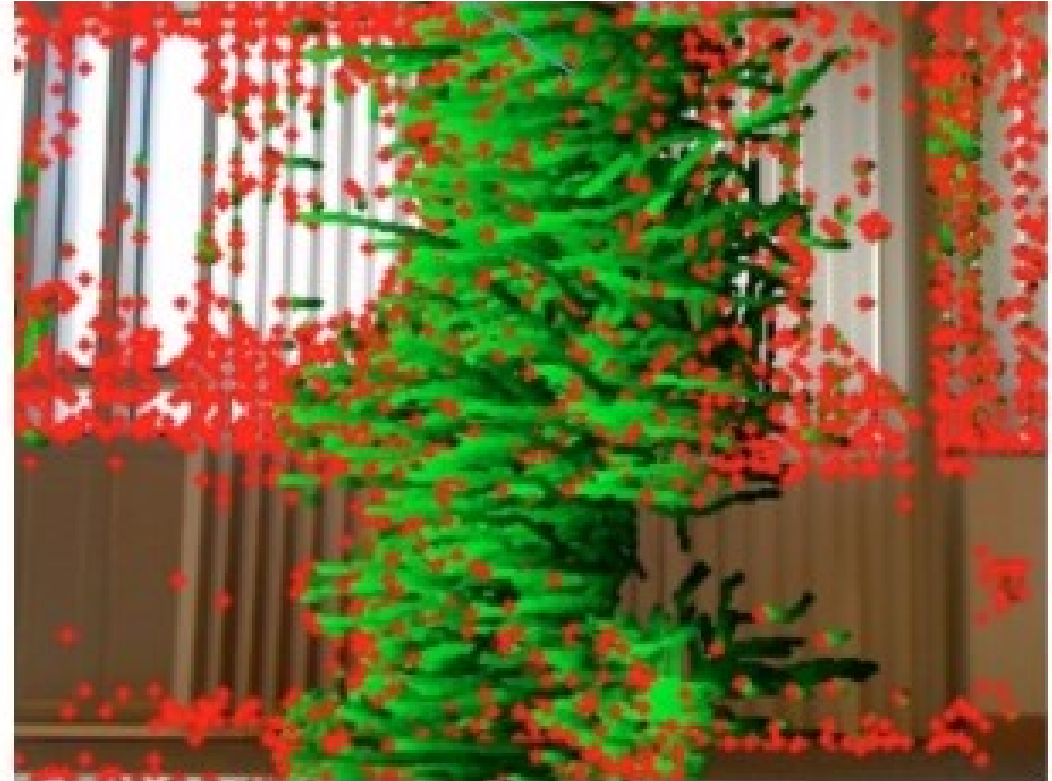
Video Visualization

- Render video frames as volume



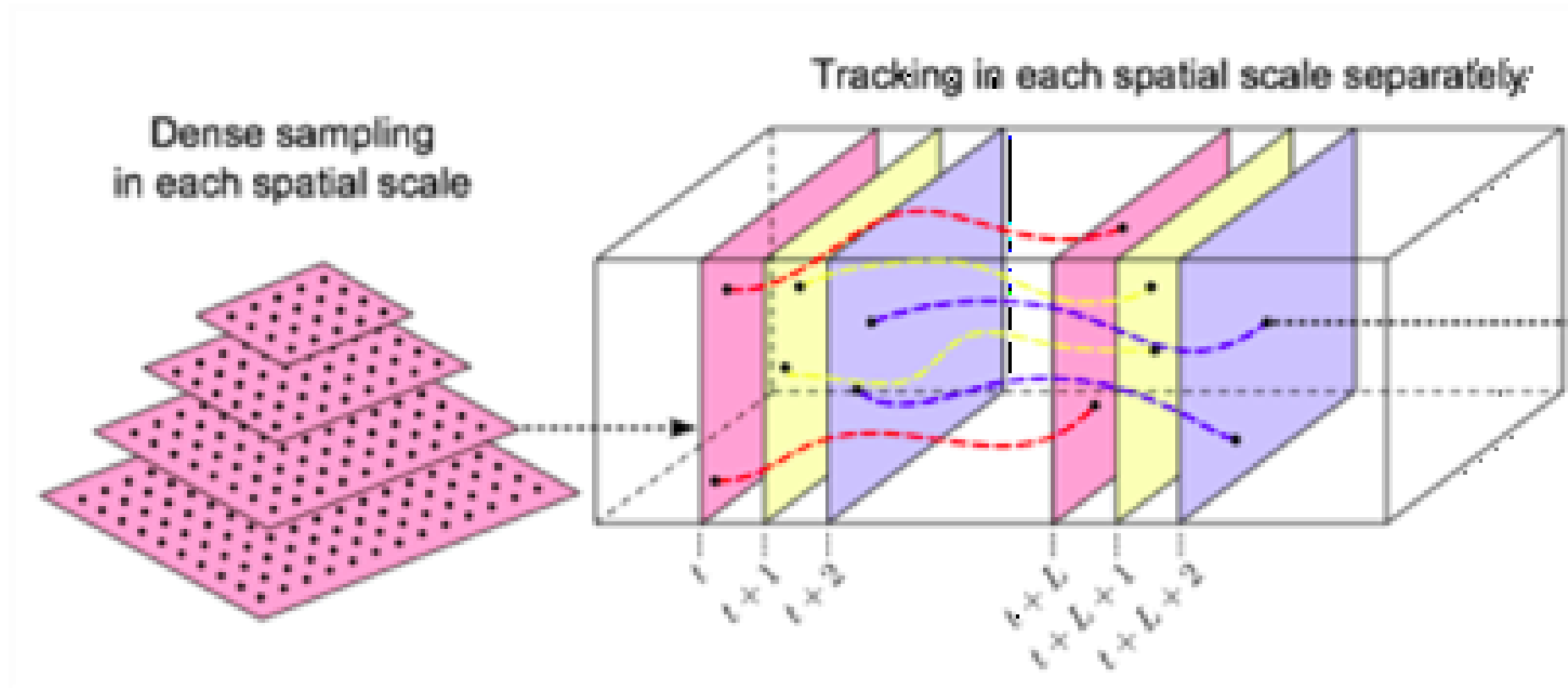
Trajectories

- Trajectories are very helpful in video visualization.



Trajectories

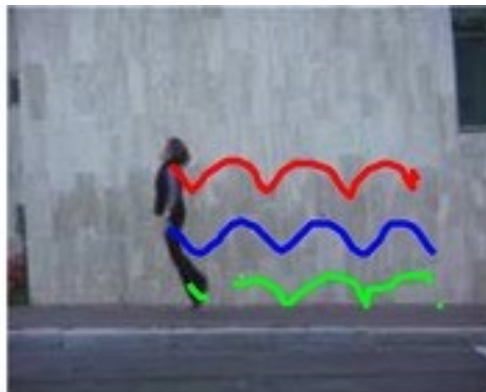
- Technique: tracking feature points on **motion trajectories**



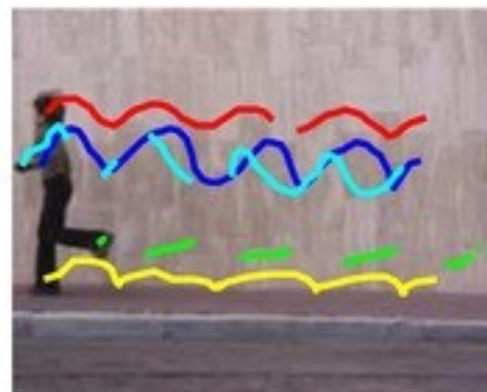
Trajectories are helpful for action understanding



(a) Bending



(b) Jumping



(c) Skipping



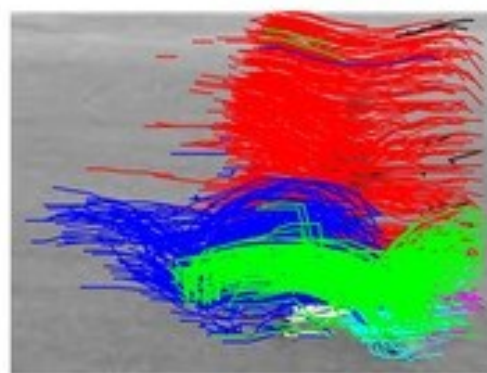
(d) Jacking



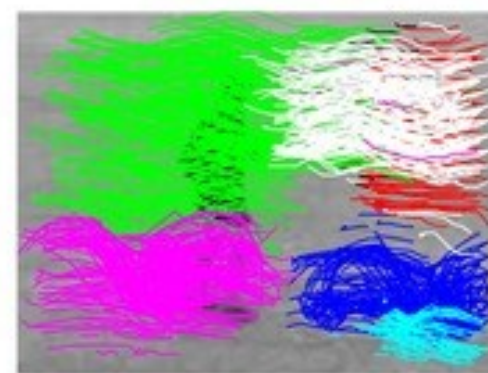
(e) Boxing



(f) Clapping

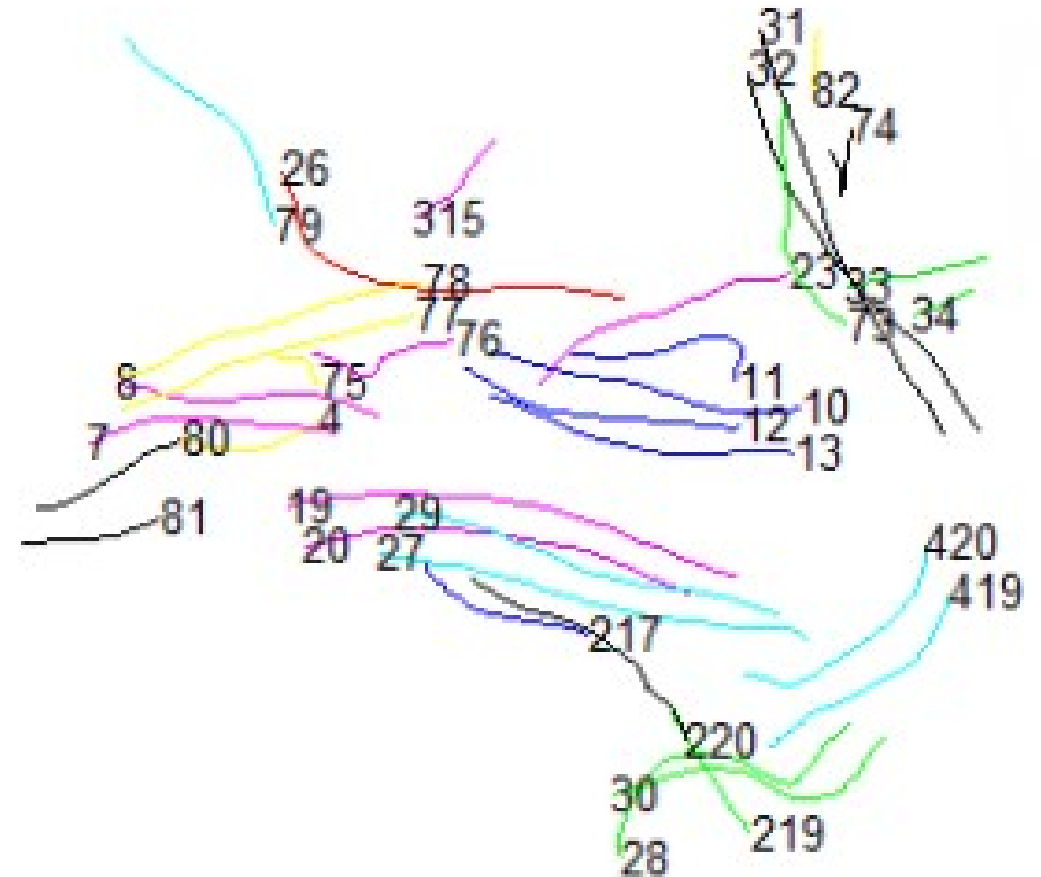


(g) Running

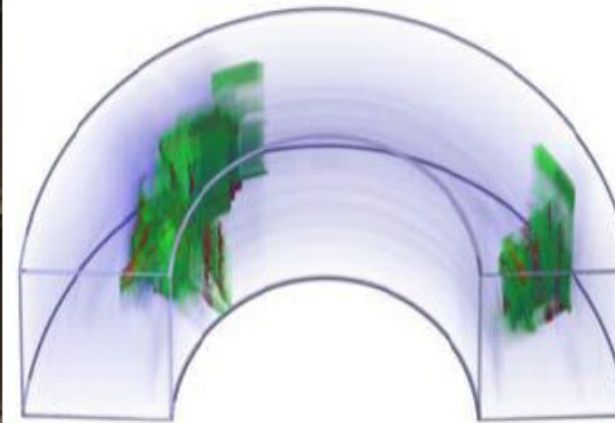
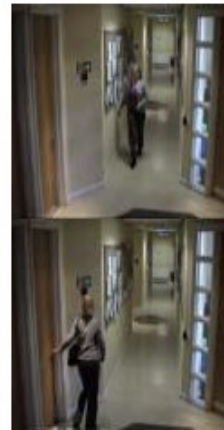
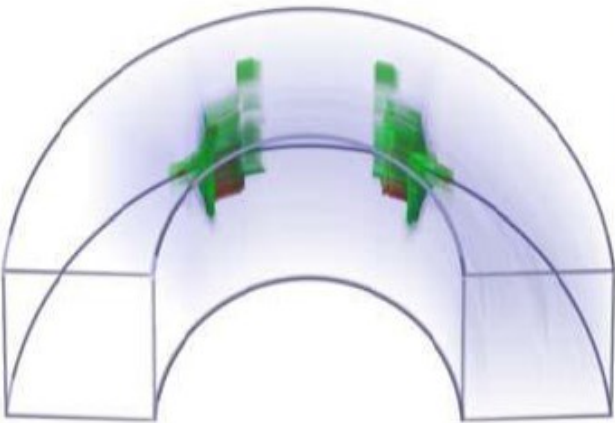
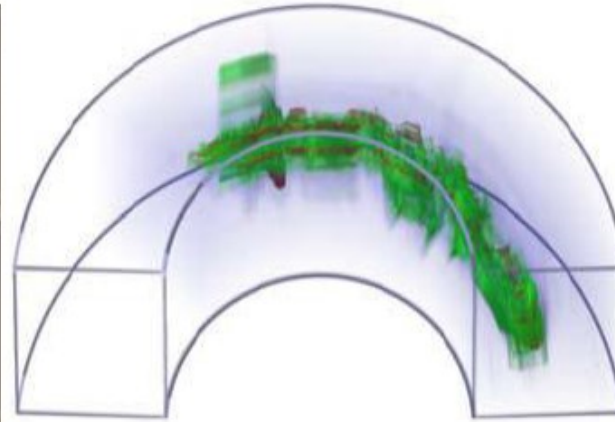
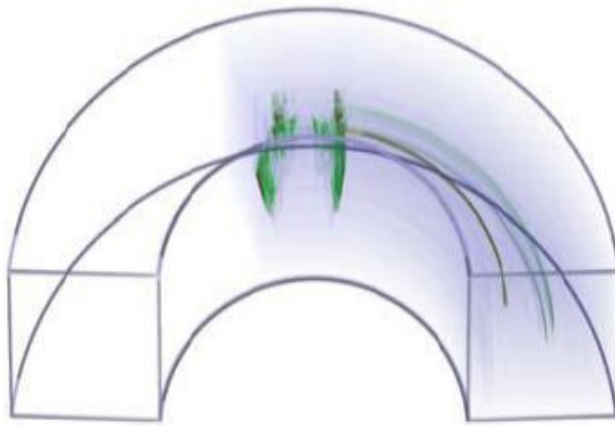


(h) Jogging

Trajectories in crowd analysis



Trajectories in volume

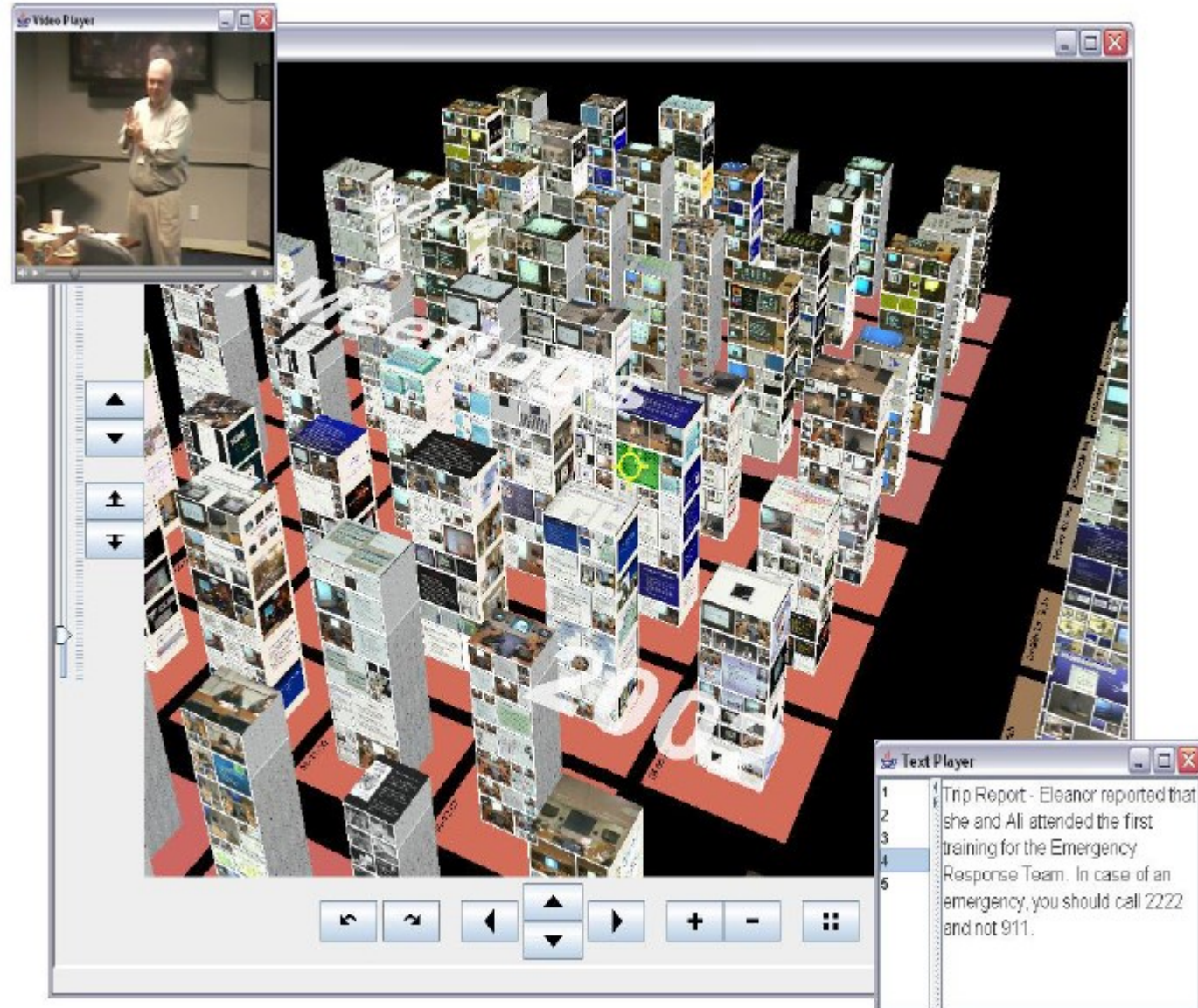


3D Visualization

- MediaMetro: Browsing Multimedia Document Collections with a 3D City Metaphor
- Patrick Chiu, Andreas Girgensohn, SurapongLertsithichai, Wolf Polak, Frank Shipman
- ACM Multimedia 2005 conference

3D Visualization

- The MediaMetro provides an interactive 3D visualization of multimedia document collections using a city metaphor. The directories are mapped to city layouts using algorithms similar to treemaps. Each multimedia document is represented by a building and visual summaries of the different constituent media types are rendered onto the sides of the building.

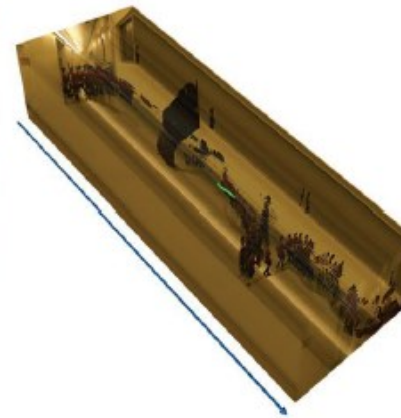
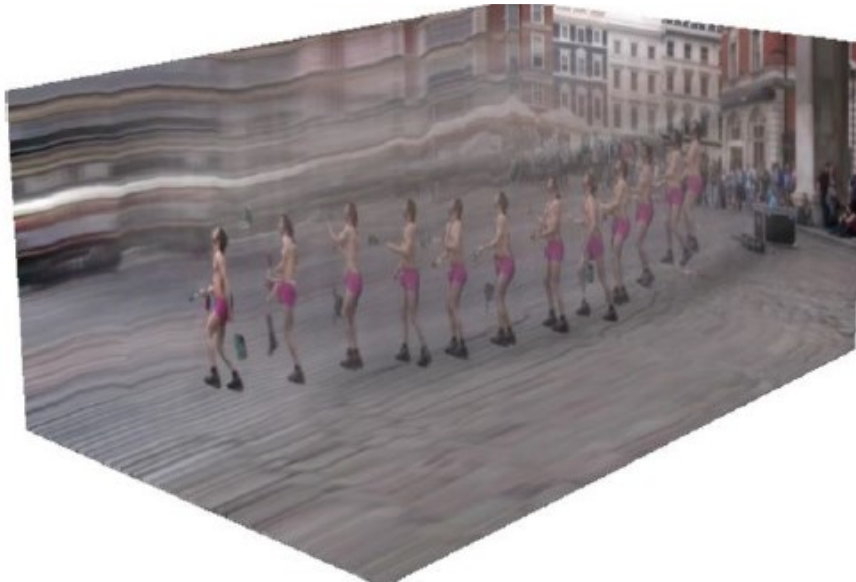


Video Summagator: Video Summarization and Navigation

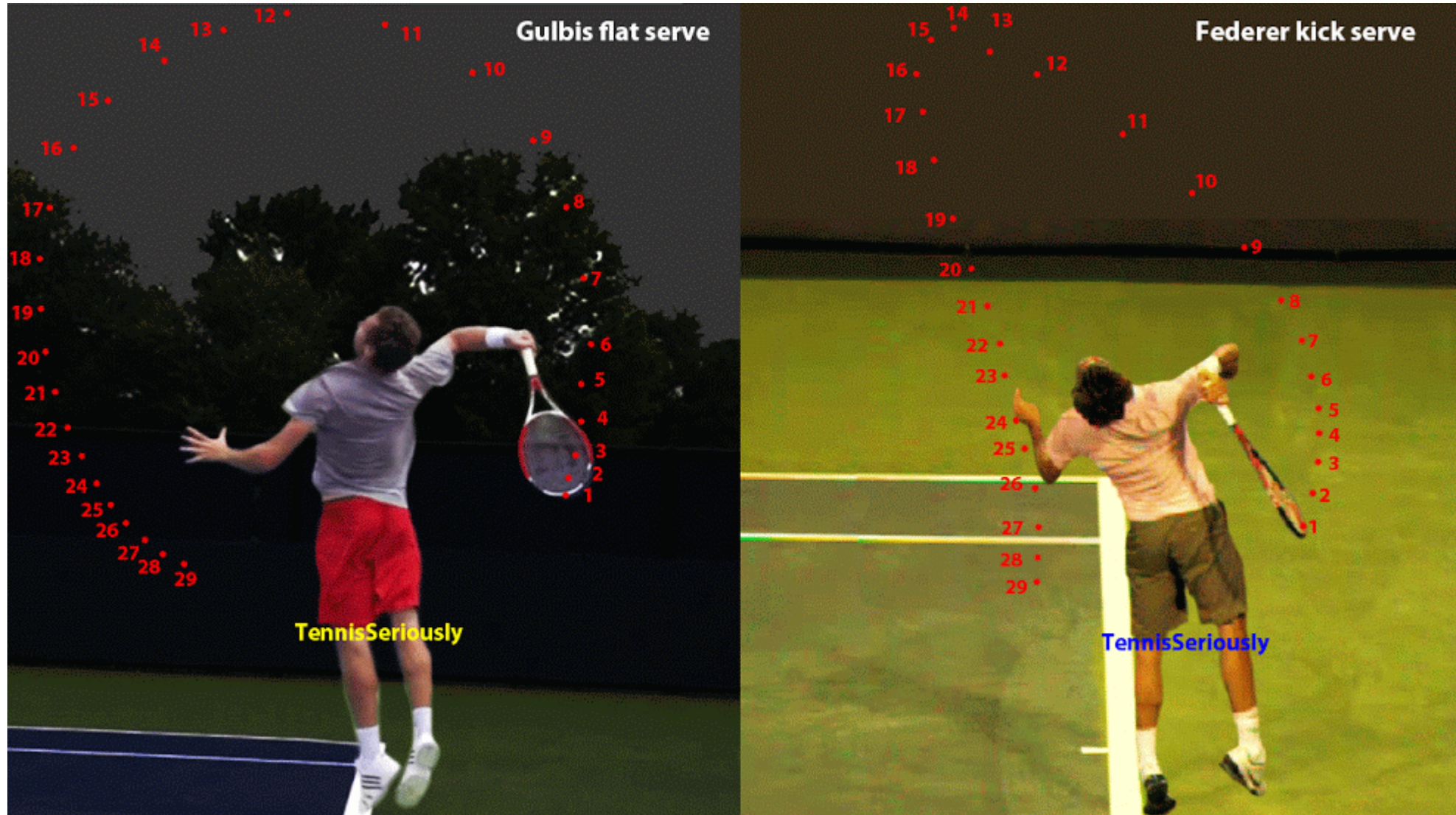
- Video Summagator: An Interface for Video Summarization and Navigation
- Cuong Nguyen, Yuzhen Niu, and Feng Liu
- *Video Summagator* visualizes a video in 3D, allowing a user to look into the video cube, and enables rapid visualization and navigation



Video Summagator



Video Summagator is also helpful for action understanding



3D Visualization in reality



<https://www.youtube.com/watch?v=mcIPB06sCYY>

Q&A