

Infinite Images

Bill Freeman (Adobe/MIT)

Josef Sivic (MIT)

Biliana Kaneva (MIT)

Shai Avidan (Adobe)

Antonio Torralba (MIT)



Tour from a single image

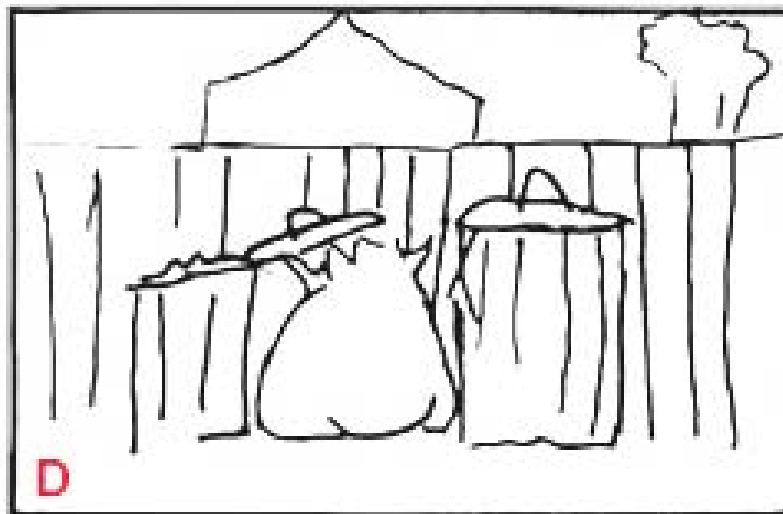


The goal

Create a large **photorealistic virtual space** from a collection of still images taken at different places and times



Boundary Extension



Automatic boundary extension



Why is this useful?

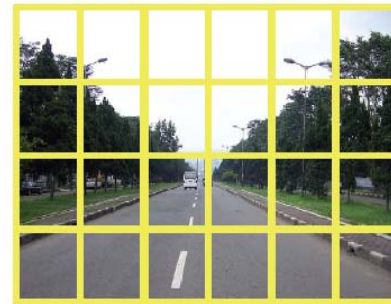
- **Intuitive 3D-like browsing of large photo collections**
 - “3D Flickr” – tour images taken by others
 - “3D PhotoAlbum” - tour your personal photo-collection
- **Creating photorealistic visual content for**
 - large on-line virtual worlds like “Second Life”
 - computer games
 - movies or advertisements

Image representation

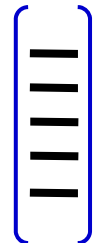
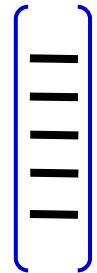
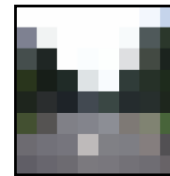
Original image



GIST
[Oliva and Torralba'01]



Color layout



Basic camera motions

Starting from a **single image**,

find a sequence of images to simulate a camera motion:

Forward motion

Forward motion



Camera rotation

Camera rotation

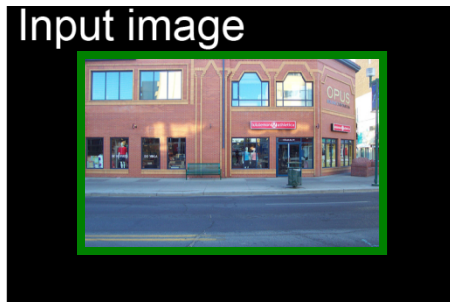


Camera pan

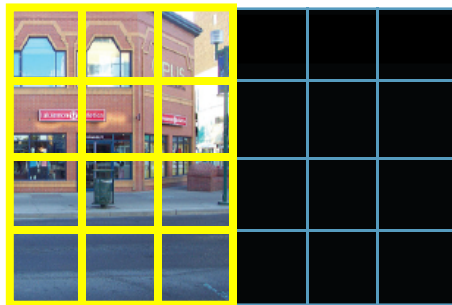
Camera translation



Scene matching with camera view transformations: Translation



1. Move camera

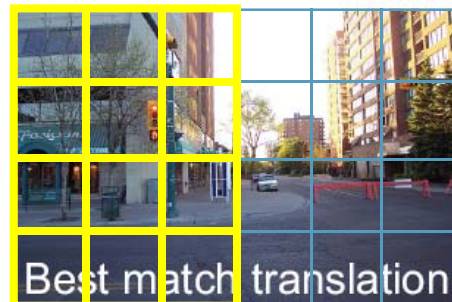


2. View from the virtual camera

4. Locally align images

5. Find a seam

6. Blend in the gradient domain

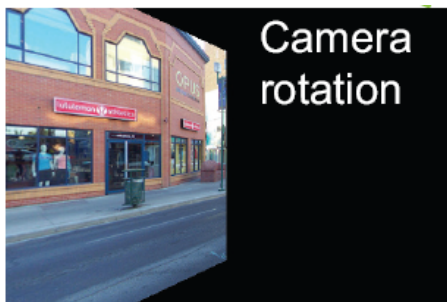


3. Find a match to fill the missing pixels

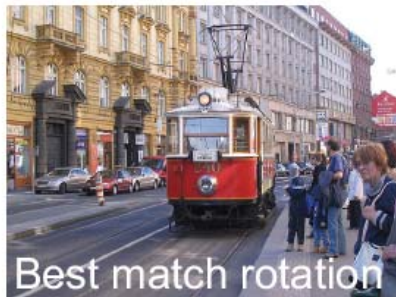
Scene matching with camera view transformations: Camera rotation



1. Rotate camera



2. View from the virtual camera



3. Find a match to fill-in the missing pixels



4. Stitched rotation



Scene matching with camera view transformations: Forward motion

Input image



1. Move camera

Forward motion



2. View from the virtual camera



3. Find a match to replace pixels

Unwrap the motion into an “infinite” image

Camera rotation:



Unwrapped



Original images



Masks and seams between images



Unwrap the motion into an “infinite” image

Forward motion:

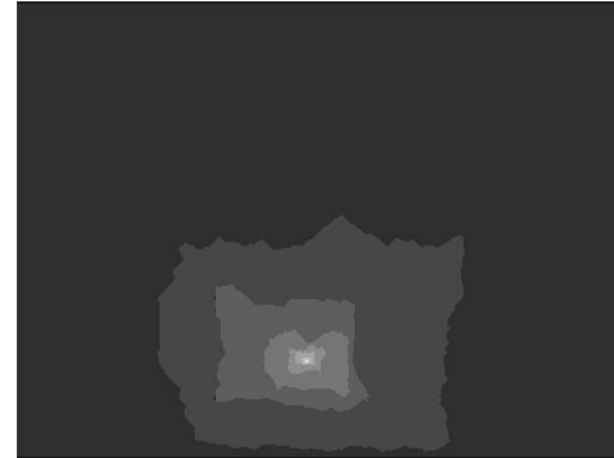
Motion video



“Infinite” image with bounding boxes overlaid



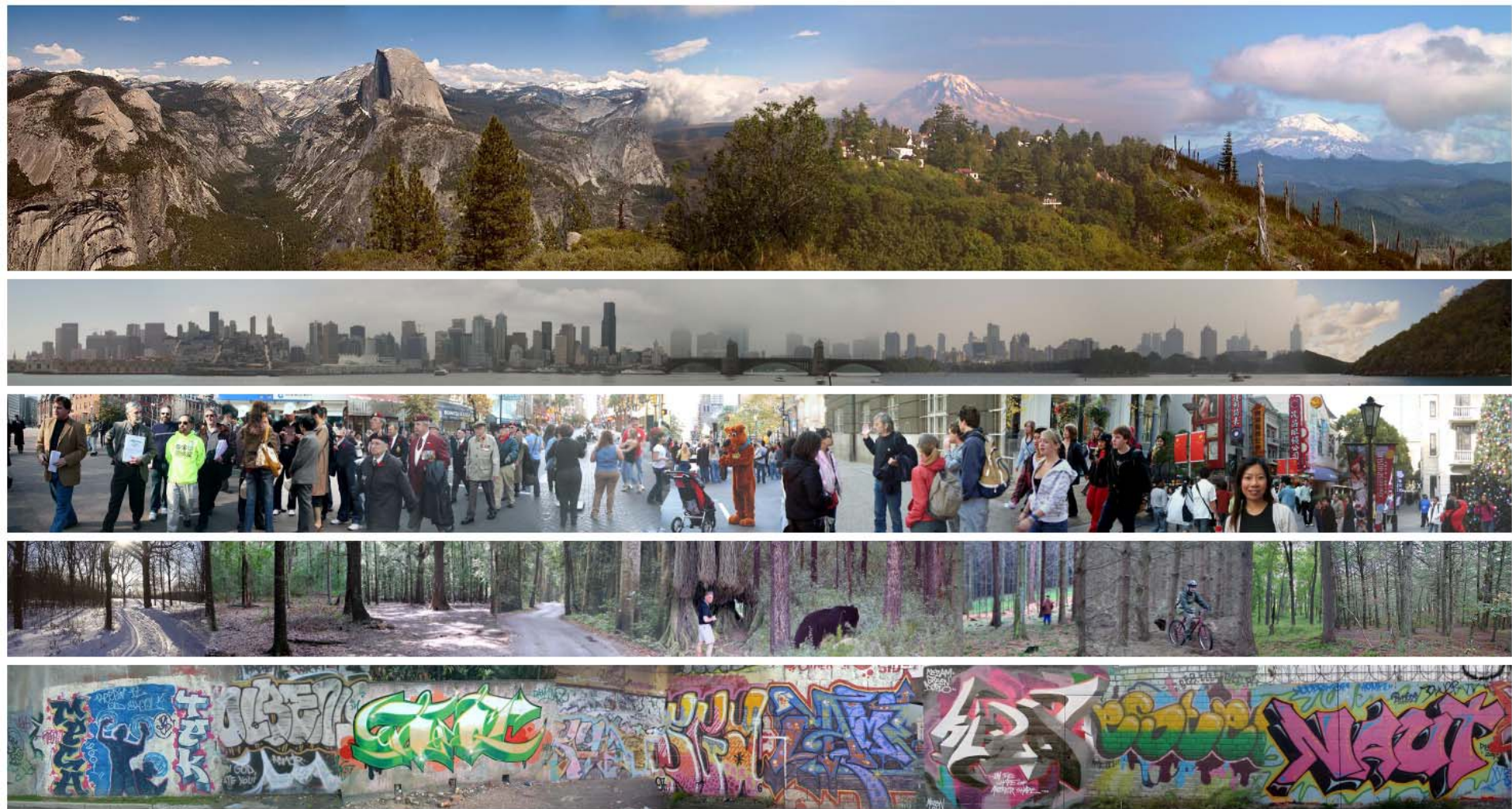
Masks and seams between images



Original images

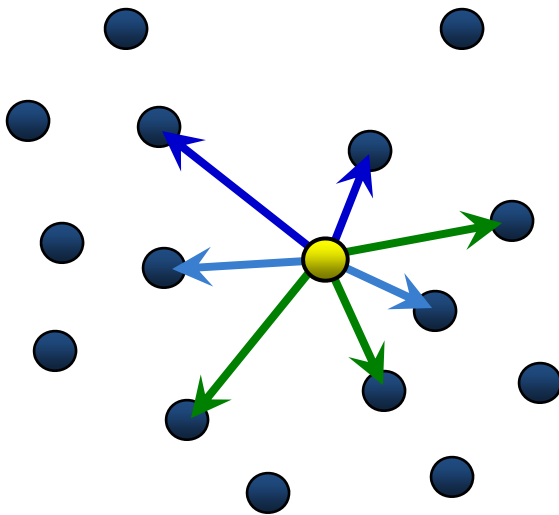


More “infinite” images – camera translation



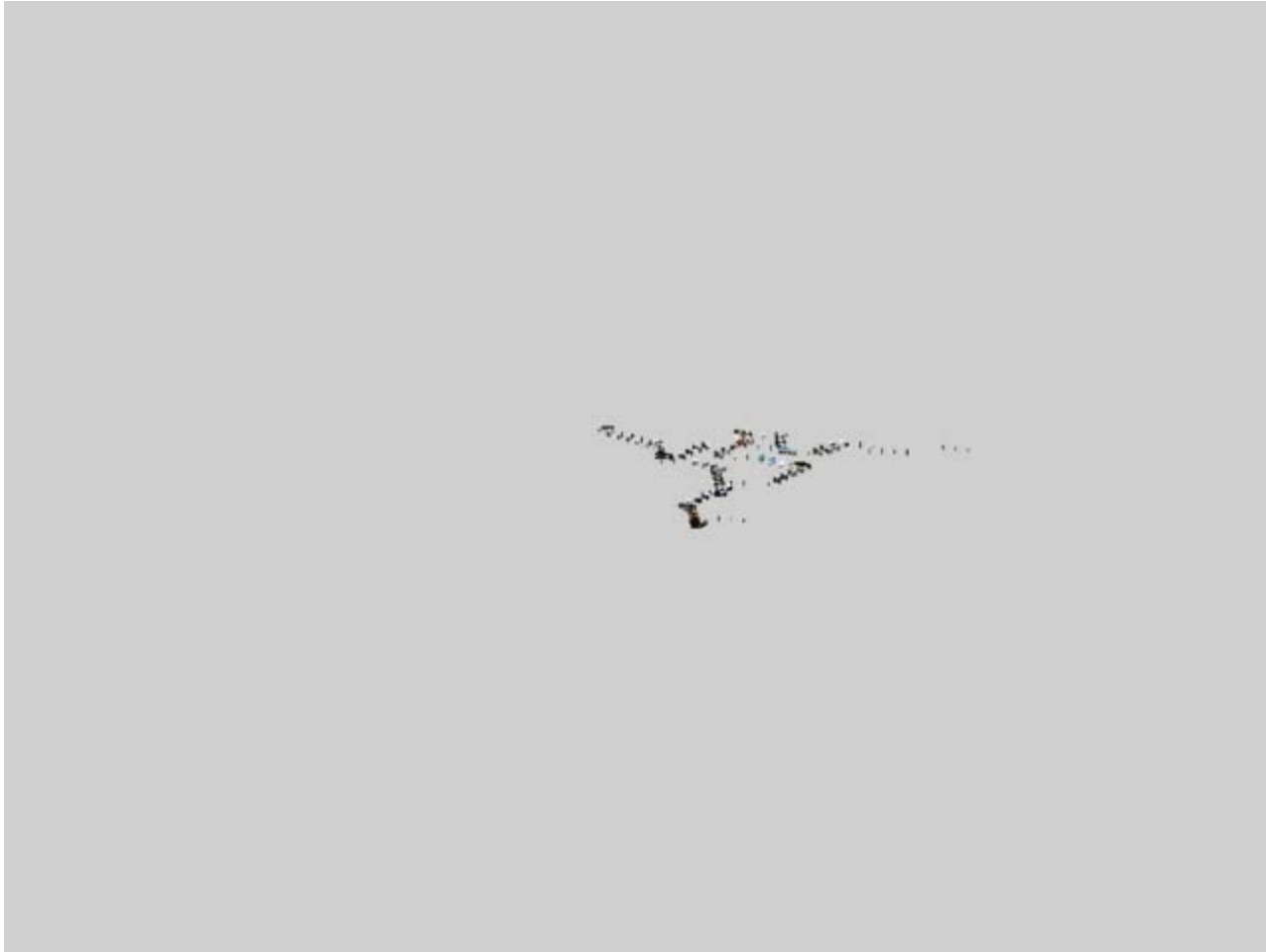
Virtual space as an image graph

Image graph



- Nodes represent Images
- Edges represent particular motions:
 - Forward
 - Rotate (left/right)
 - Pan (left/right)
- Edge cost is given by the cost of the image match under the particular transformation

Travel a path in the virtual 3D space



- **Motion based queries**
 - Find the lowest cost path with a particular motion
(e.g. 3 rotations followed by 10 forward motions)
- **Image taxi**
 - Find the lowest cost path connecting two given images

Start



Finish



Start



Finish



Exploring famous sites



The end

