

# Infinite Images

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# Tour from a single image

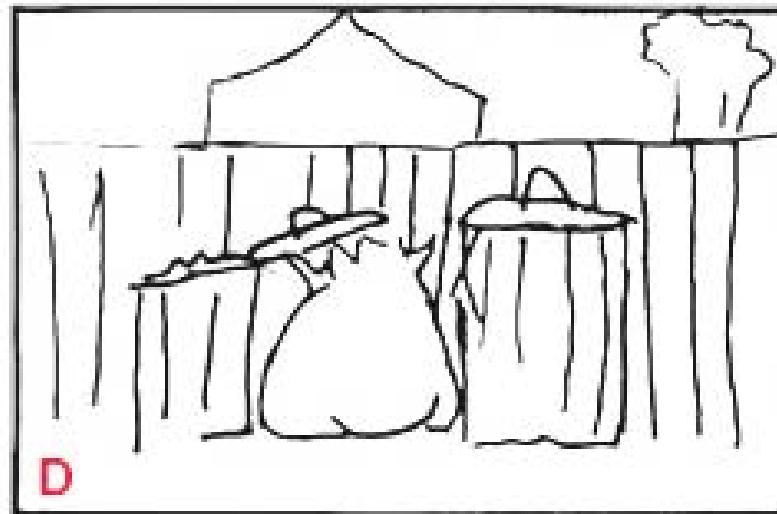


# The goal

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



# Boundary Extension



# Automatic boundary extension

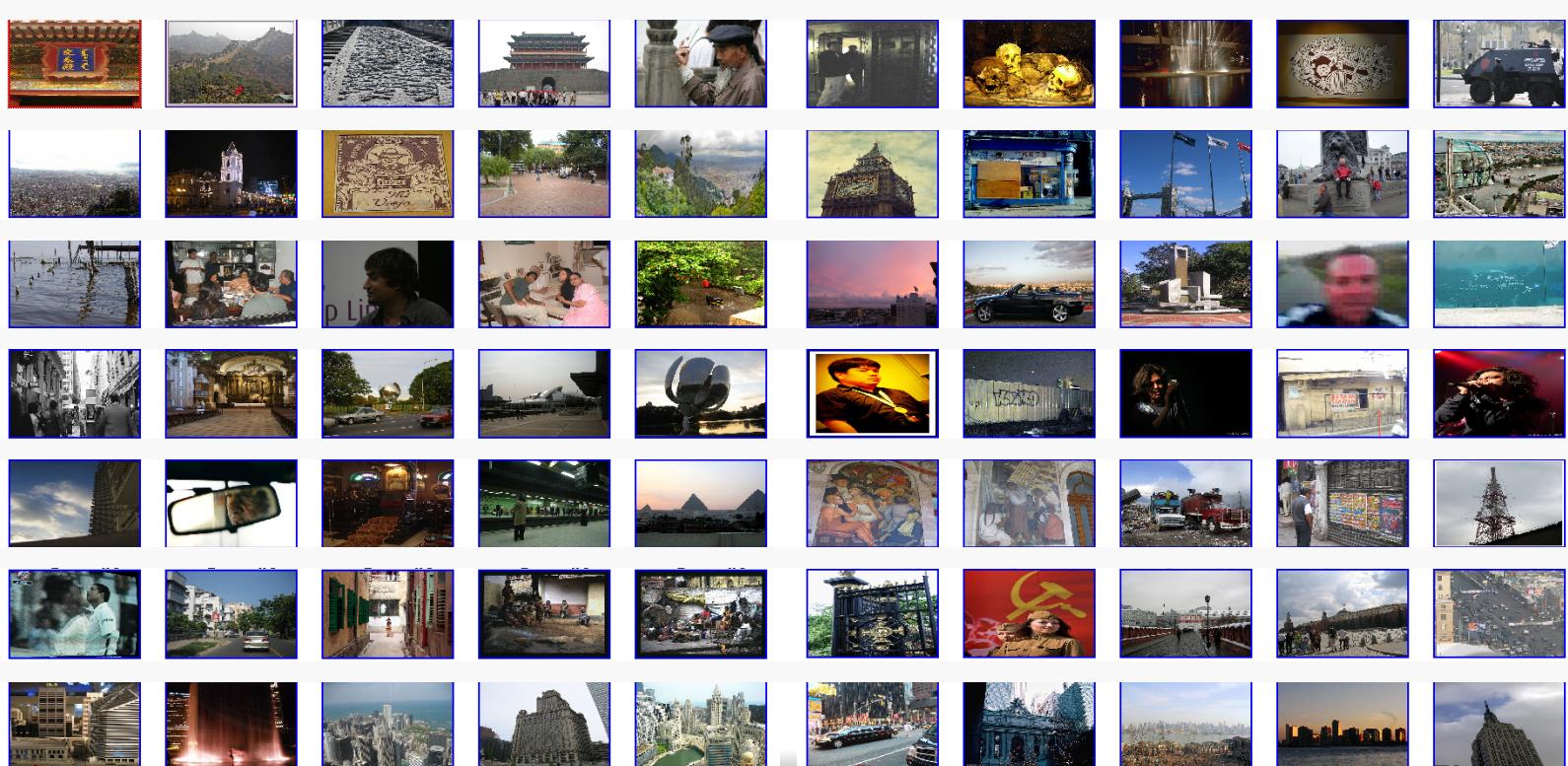


# Why is this useful?

- **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**

# The image database

- We have collected ~6 million images from Flickr based on keyword and group searches
  - typical image size is 500x375 pixels
  - 720GB of disk space (jpeg compressed)

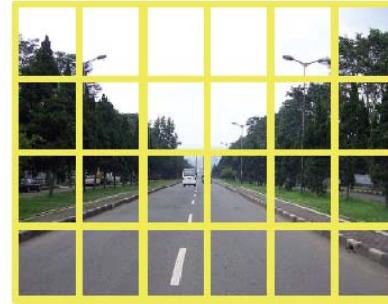


# Image representation

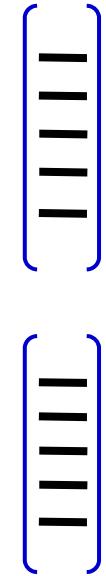
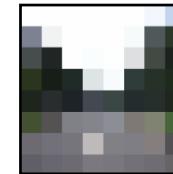
Original image



**GIST**  
[Oliva and Torralba '01]



Color layout

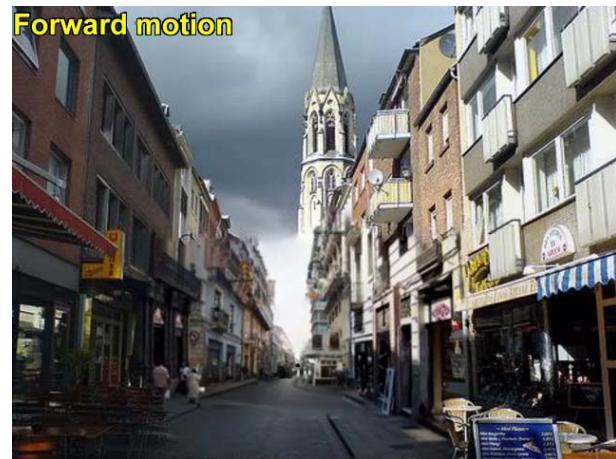


# Basic camera motions

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**



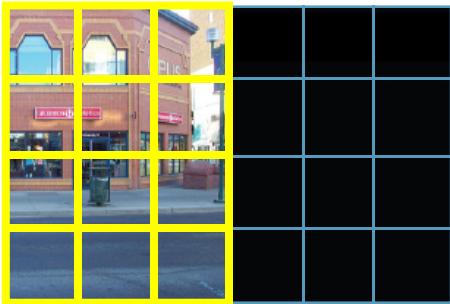
Camera translation

# Scene matching with camera view transformations: Translation

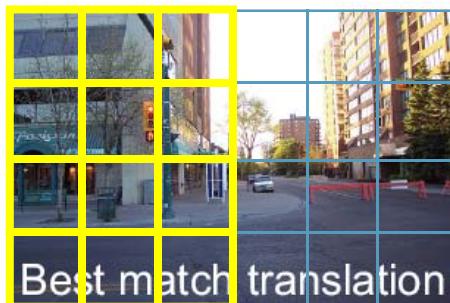
Input image



1. Move camera



2. View from the virtual camera



3. Find a match to fill the missing pixels

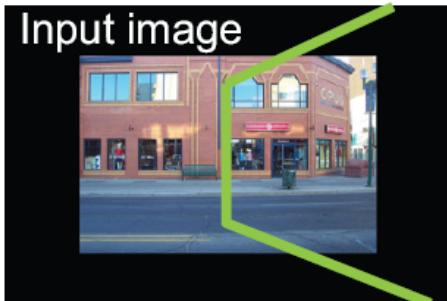


4. Locally align images

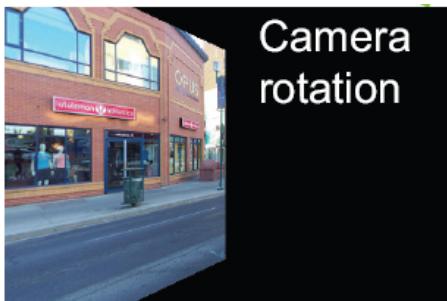
5. Find a seam

6. Blend in the gradient domain

# Scene matching with camera view transformations: Camera rotation



1. Rotate camera



2. View from the virtual camera



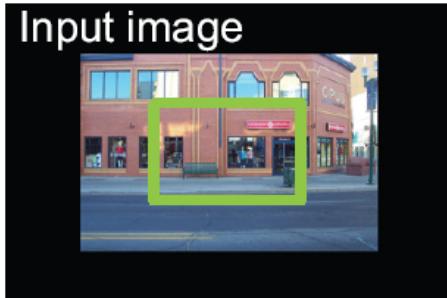
3. Find a match to fill-in the missing pixels



4. Stitched rotation



# Scene matching with camera view transformations: Forward motion



1. Move camera



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:

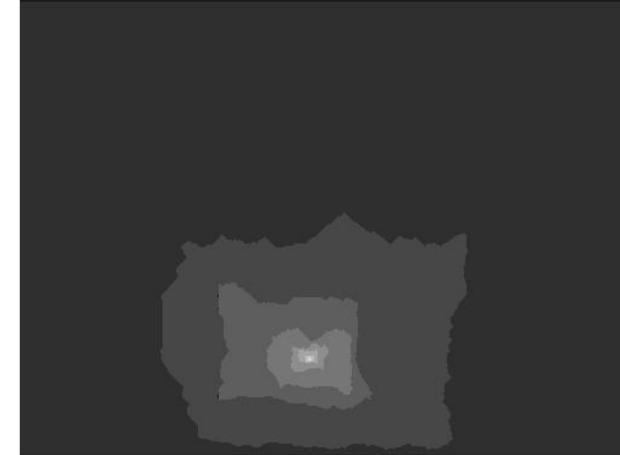
**Motion video**



**“Infinite” image with bounding boxes overlaid**



**Masks and seams between images**



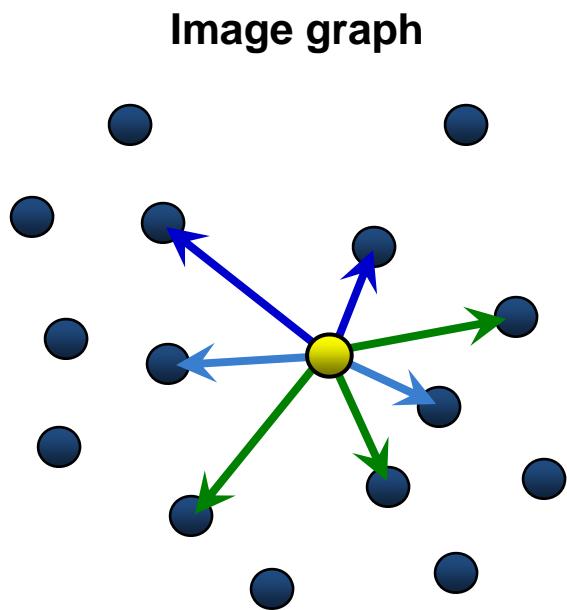
**Original images**



# More “infinite” images – camera translation

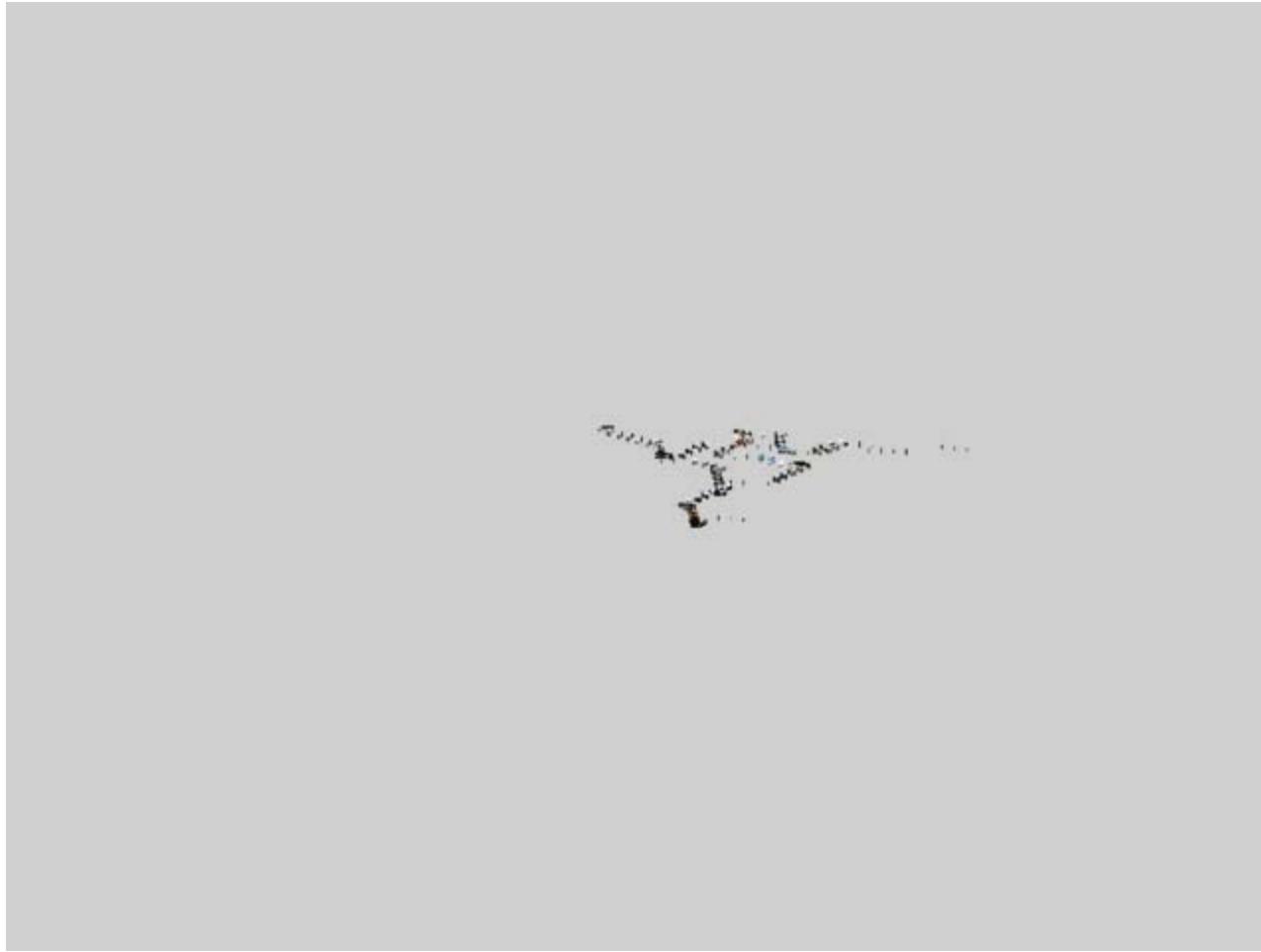


# Virtual space as an image graph



- 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



# Querying the image graph

- **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**



# Image taxi

Start



Finish



# Exploring famous sites



# The end

