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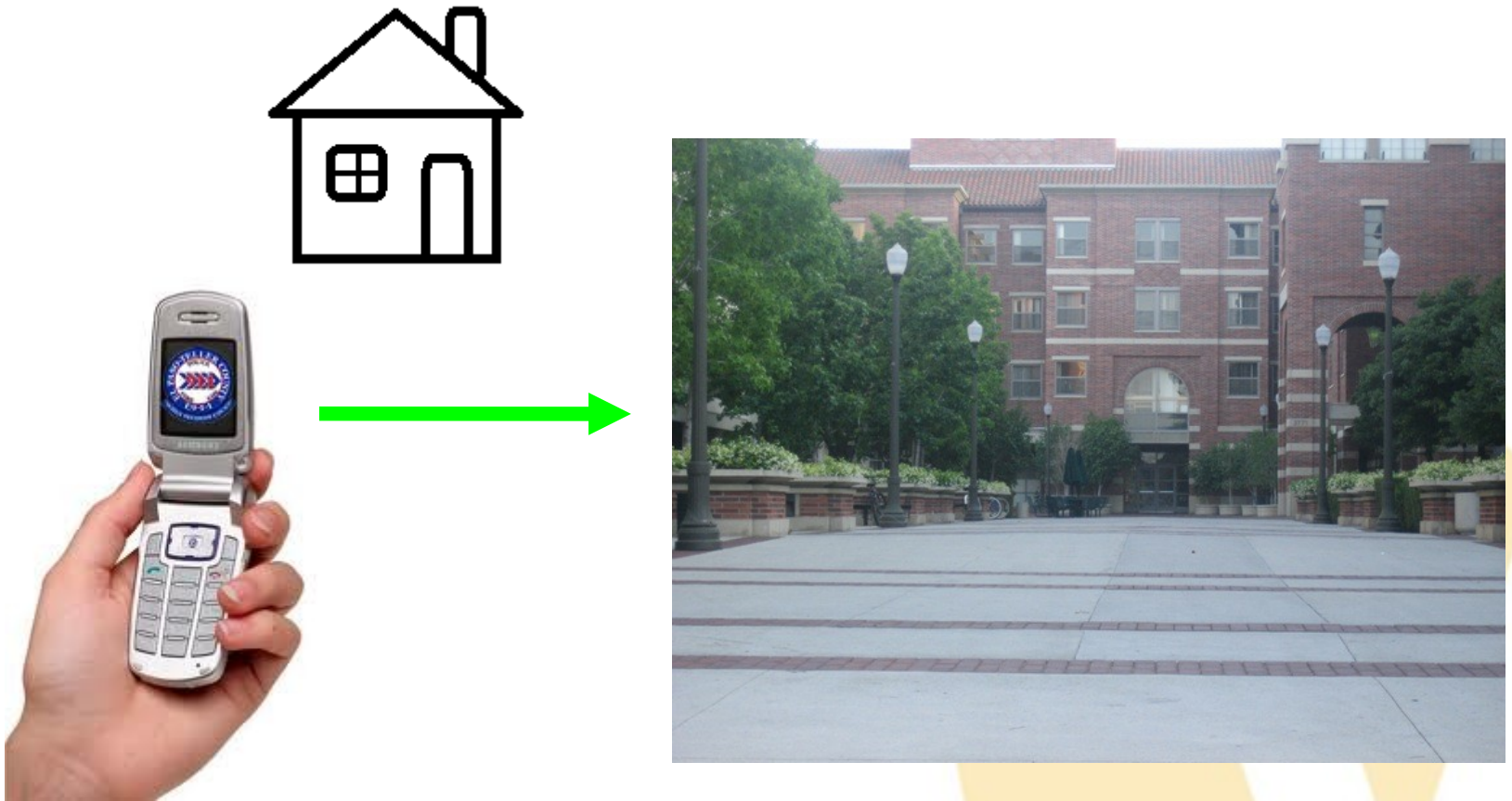
GPS-Aided Recognition-Based User Tracking System with Augmented Reality in Extreme Large-Scale Areas

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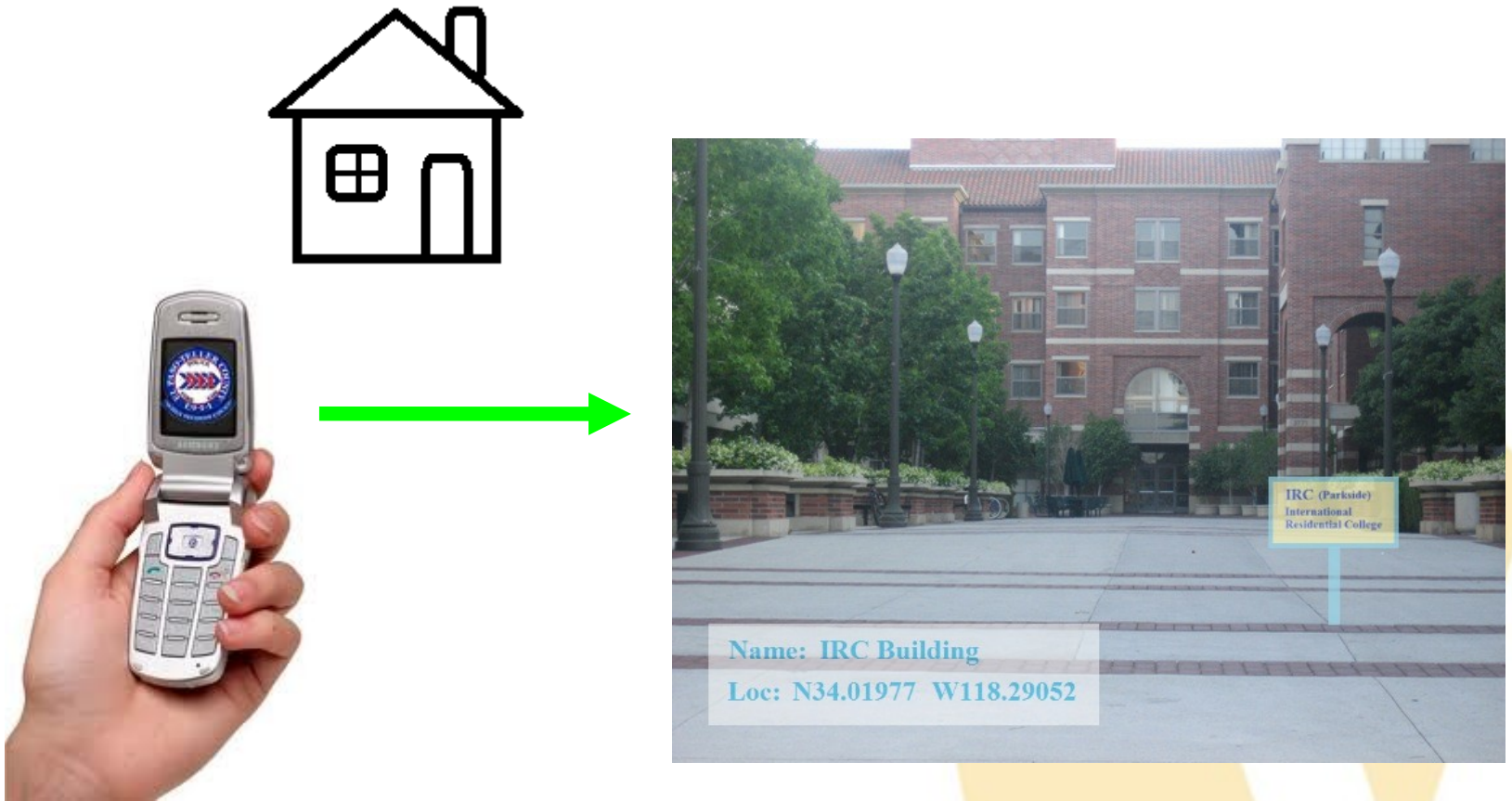
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The Project Goal



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The Project Goal



Augmented with a 2D label and a 3D sign.

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The Project Goal



Location indicator on a 2D map.



Augmented with a 2D label and a 3D sign.

Types of Hardware:

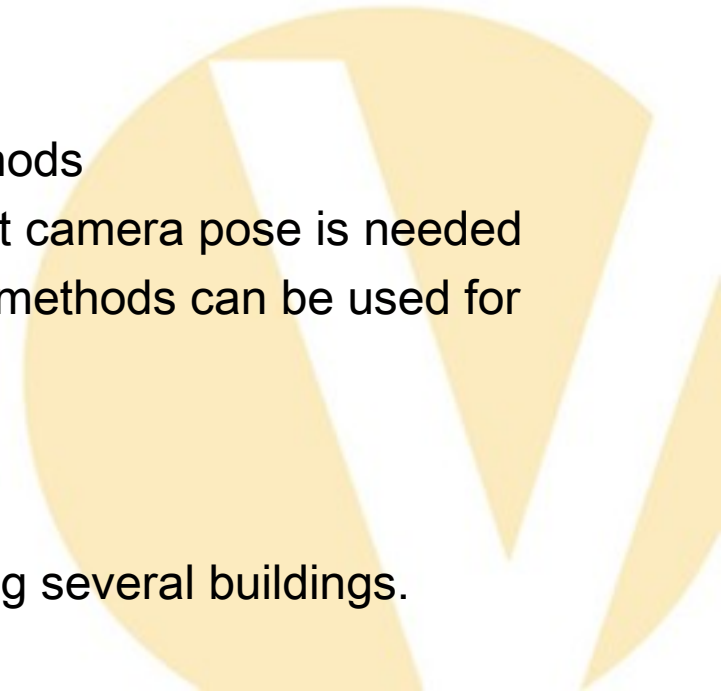
- GPS – absolute location
- Compass – absolute direction
- Accelerometer – relative motions
- Gyroscope – relative rotations
- Etc.

Why need vision methods?

- Accuracy: hardware \ll vision-based methods
- Especially for the augmented reality, exact camera pose is needed
- Images provide lots of information, vision methods can be used for content analysis

Hardware very helpful

- limiting the searching range, search among several buildings.

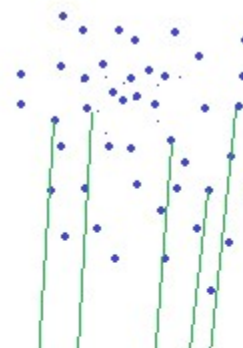


Database

- 1 – a collection of landmark images from different viewpoints
 - images are clustered according to their locations
- 2 – a 3D point cloud for each landmark
- 3 – SURF descriptors for both 2D images and 3D point cloud



(1)

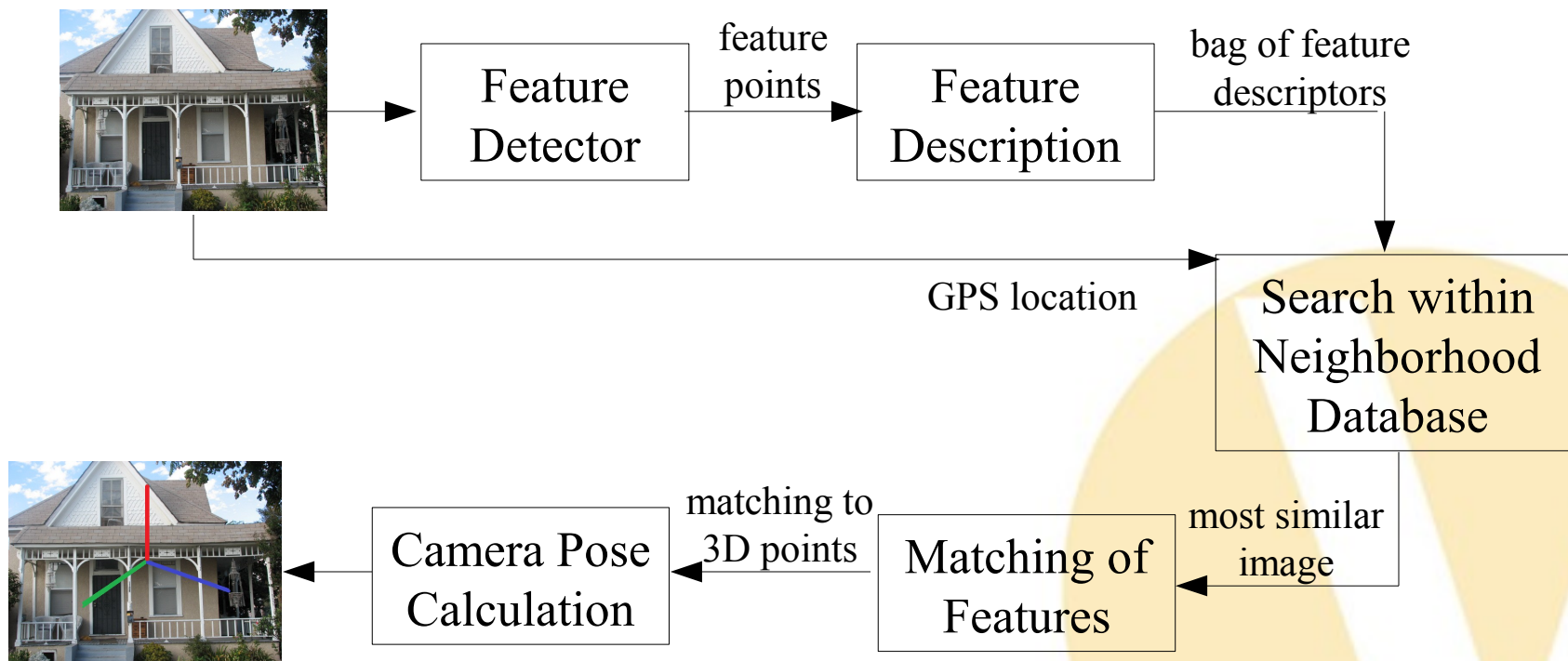


(2)



(3)

Online Tracking

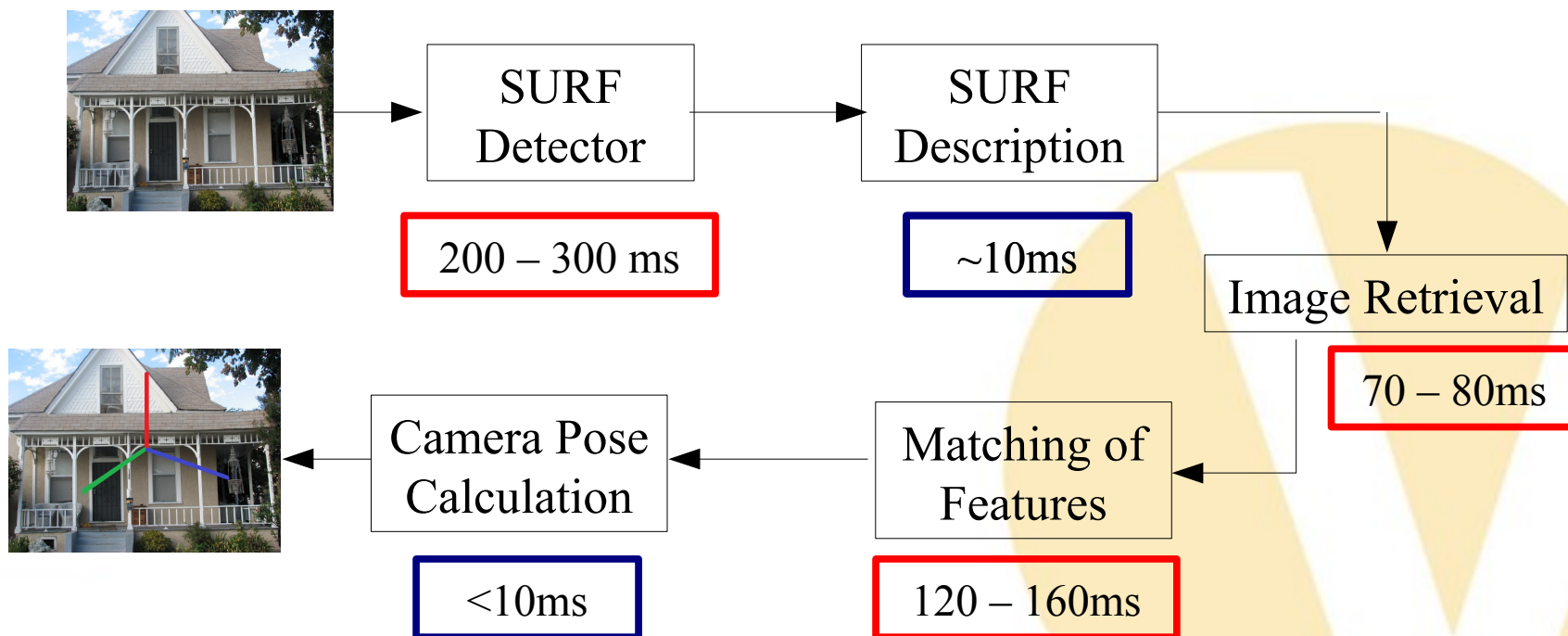


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Timing for each component

Timing Analysis

- On 1.6GHz CPU
- SURF features are used
- 6-level vocabulary tree is used for image retrieval



SURF detector

- Scale-invariant feature detection is time consuming
- We use weak detector such as FAST
- Scale-invariant is compensated in database images with different scales

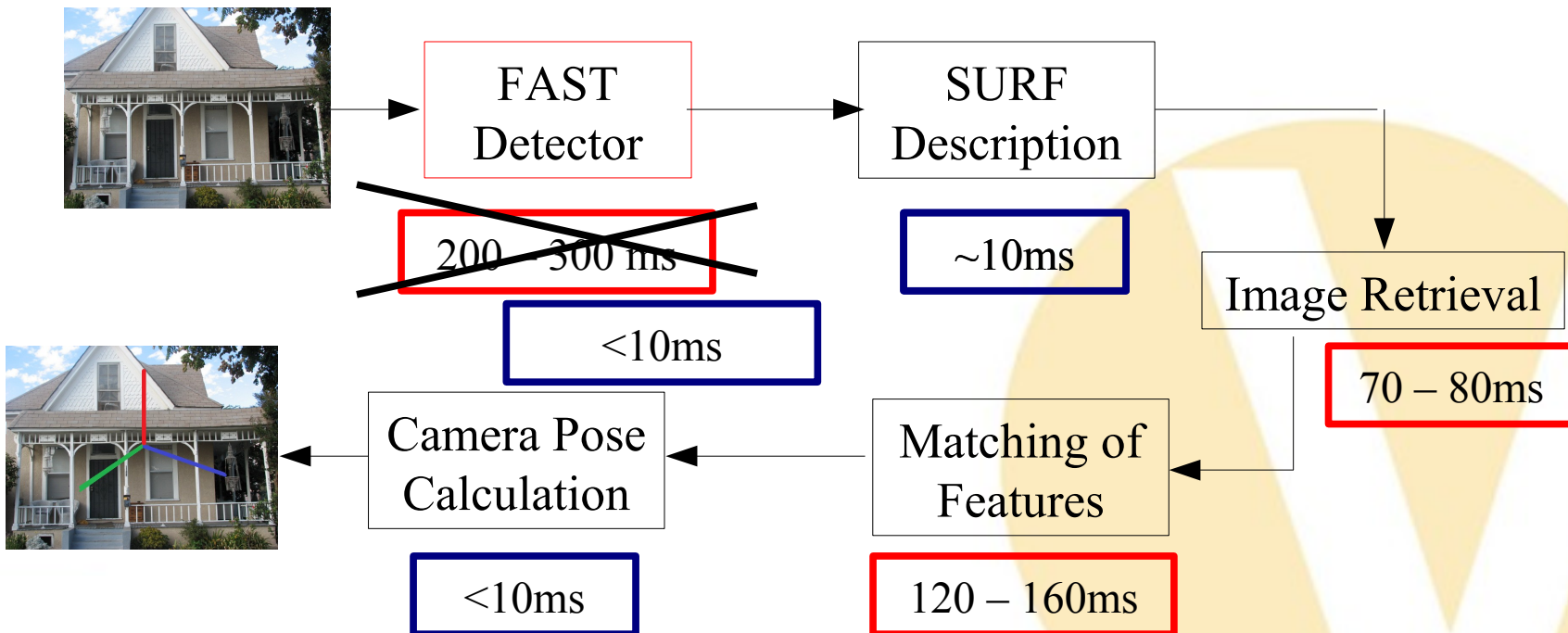
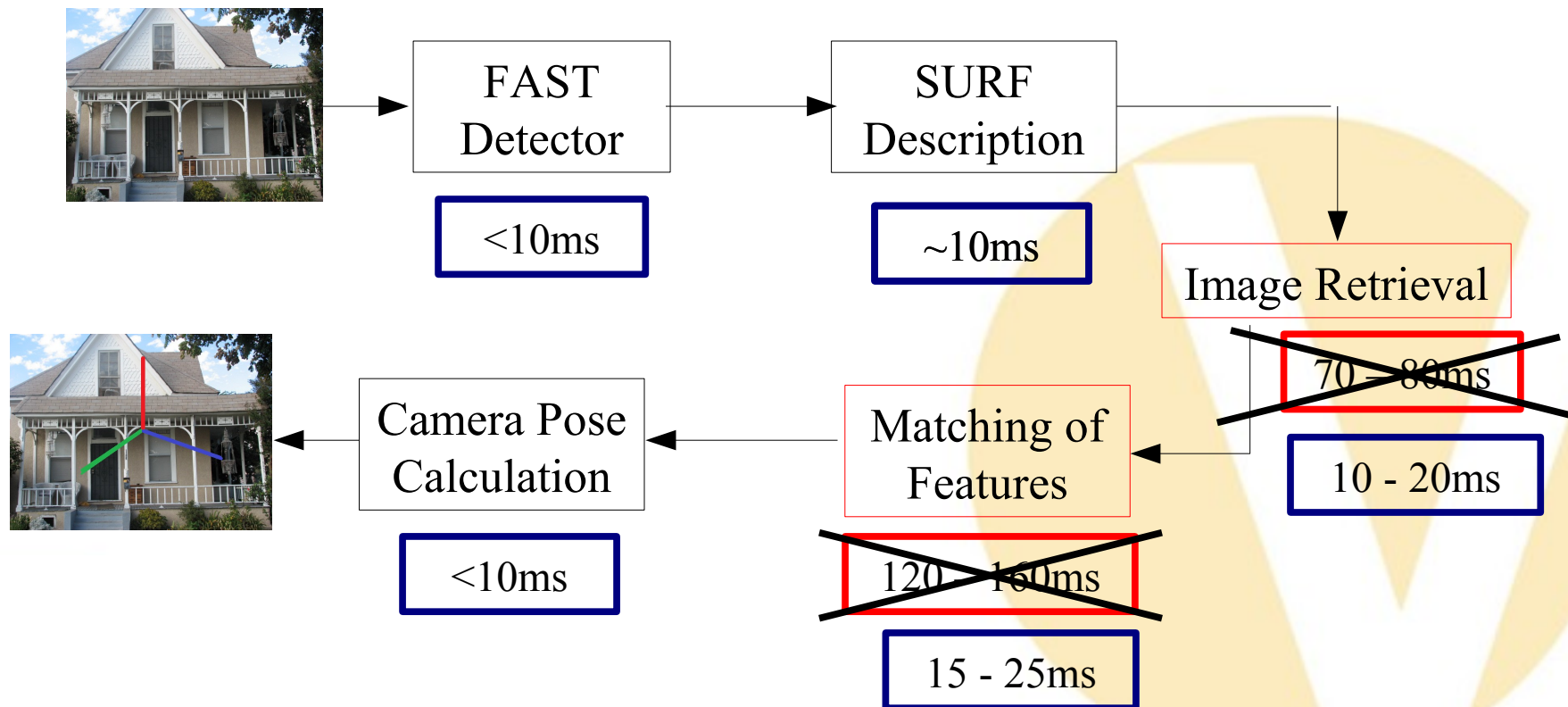


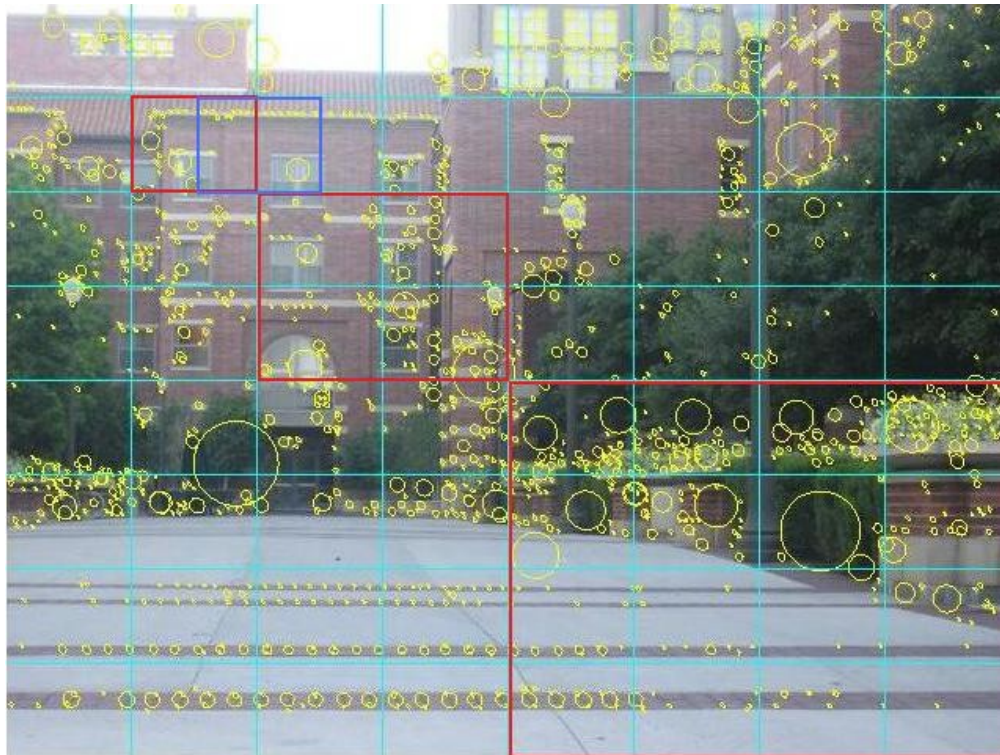
Image Retrieval and Feature Matching

- Smaller patches are used in the retrieval process
- Patch matching instead of image matching
- Feature matching is propagated into the whole image



Retrieval → multiple smaller patch retrievals

- Sometimes also avoid partial occlusions

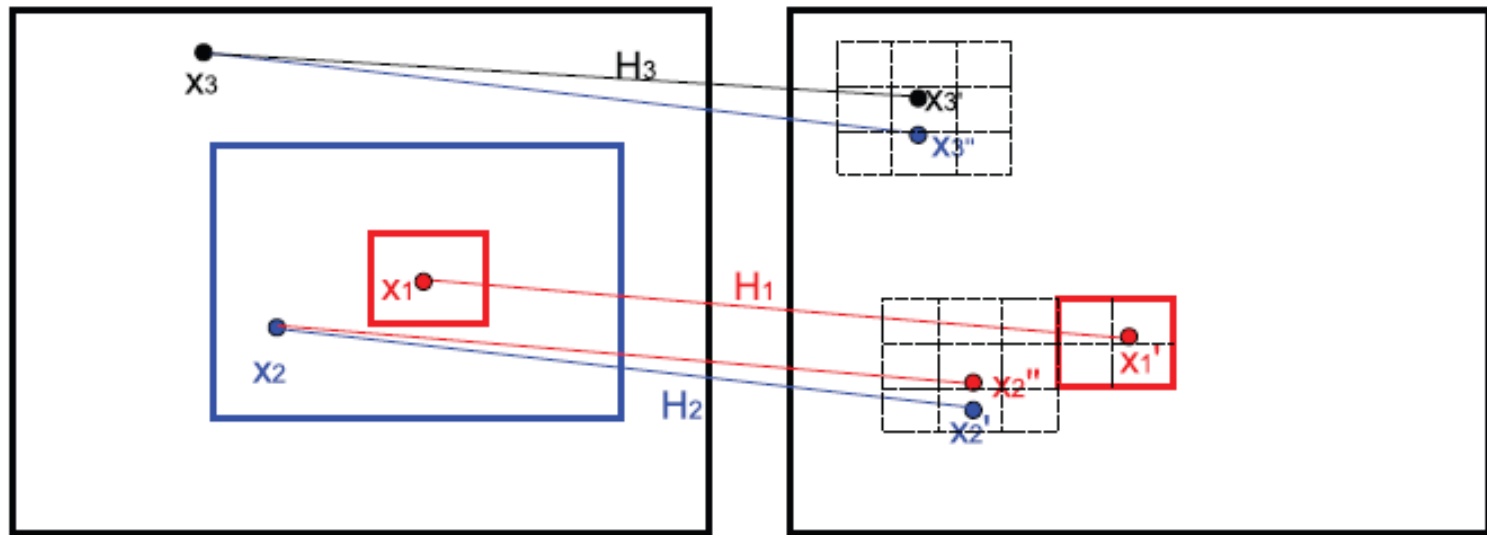


Retrieval → multiple smaller patch retrievals

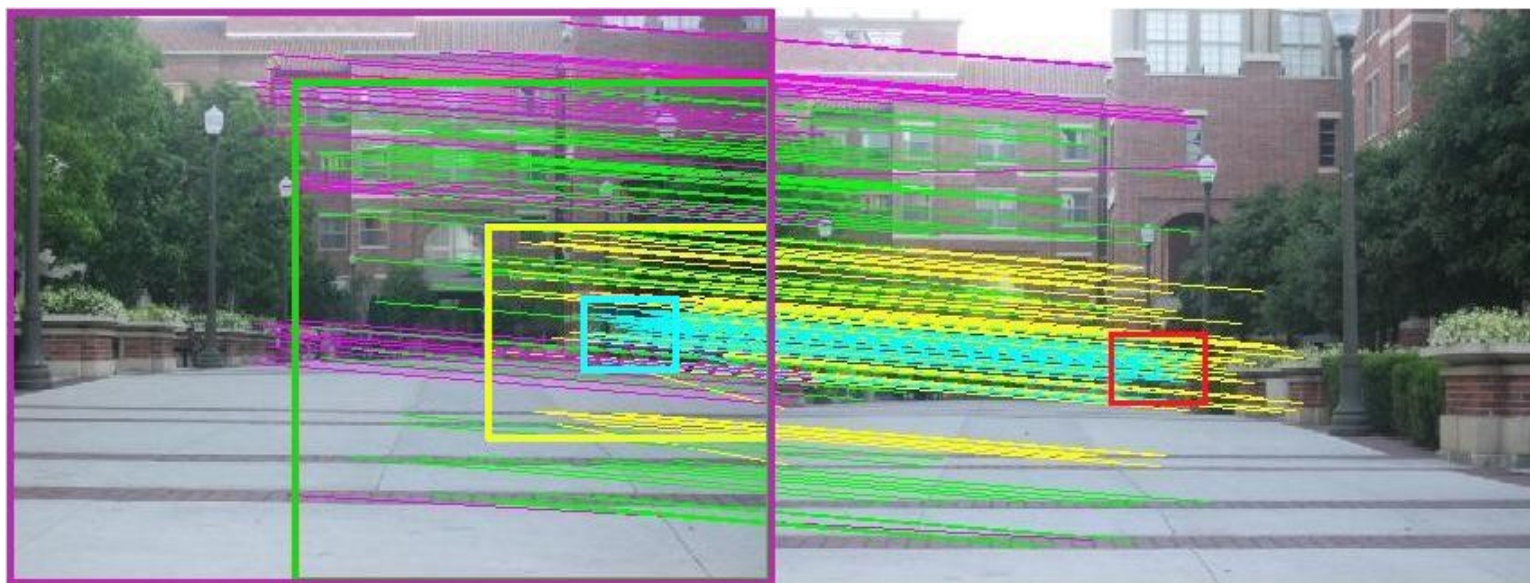
- Sometimes also avoid partial occlusions



Matching → **smaller patch matching + propagation**



Matching → **smaller patch matching + propagation**



Patch Approach

- the retrieval process 3 – 6 times faster
- Feature matching process 4 – 7 times faster
- Algorithm applies to both indoor and outdoor scenes (video)

User Tracking System

- The camera pose is tracked with aid of GPS to limit the searching range.
- Weak features are used to increase the feature detection time, but database stores images with different scales.
- Patch approach is employed so that the whole system works in real time.
- For more details, please refer to the paper.

Thank You!

Q & A

