# Automatic Tag Generation and Ranking for Sensor-rich Outdoor Videos

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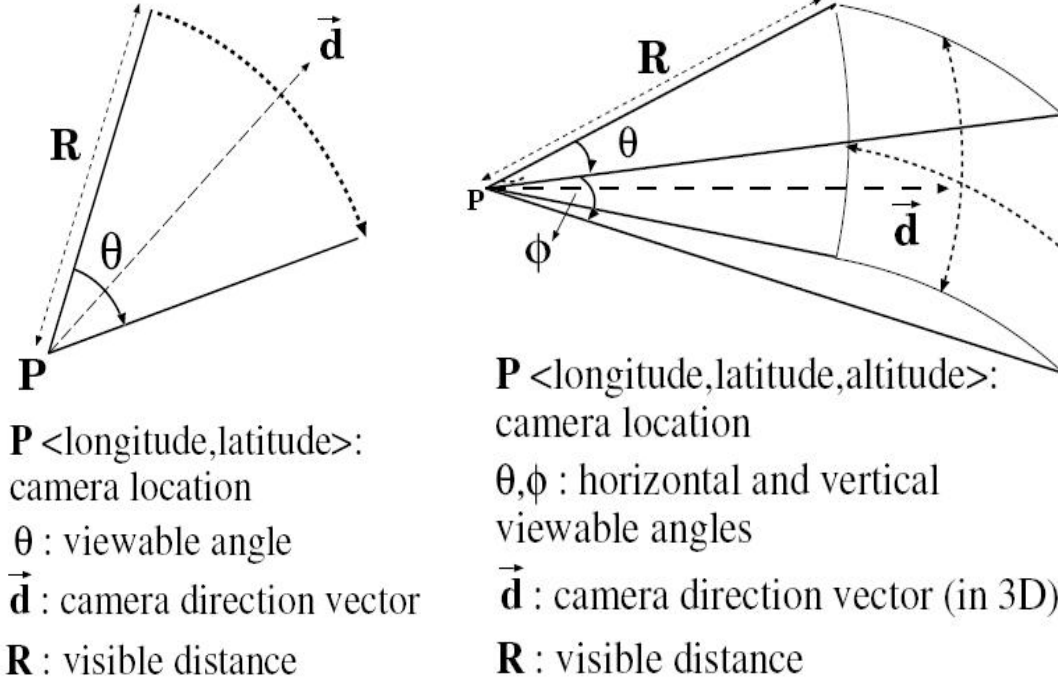‡Integrated Media Systems Center, University of Southern California

**ICampus** ✓   **IWatch** ✓   **CT**

## Background and Motivation
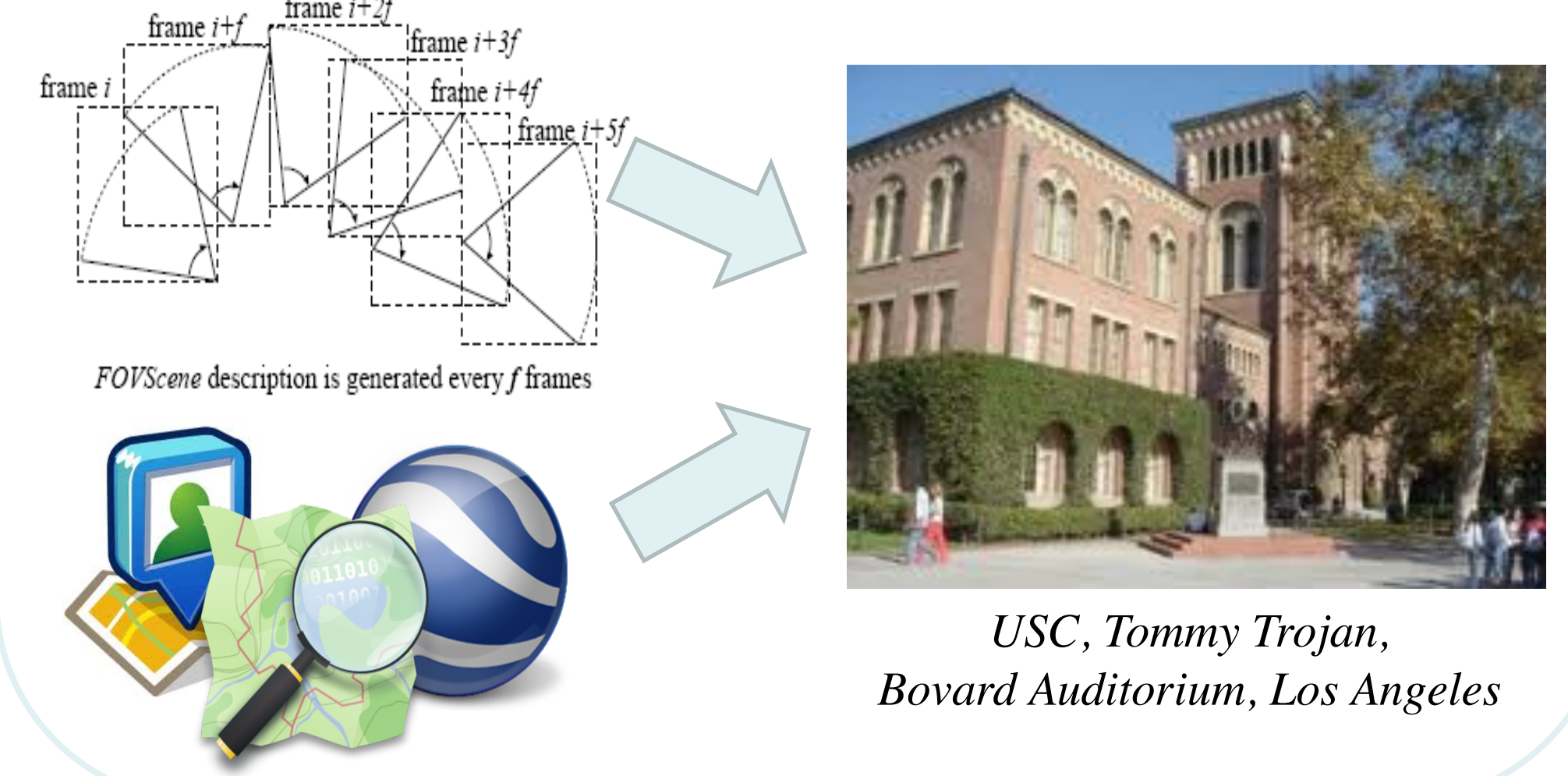
**Video and sensor data capturing apps:**

**Viewable scene modeling:**
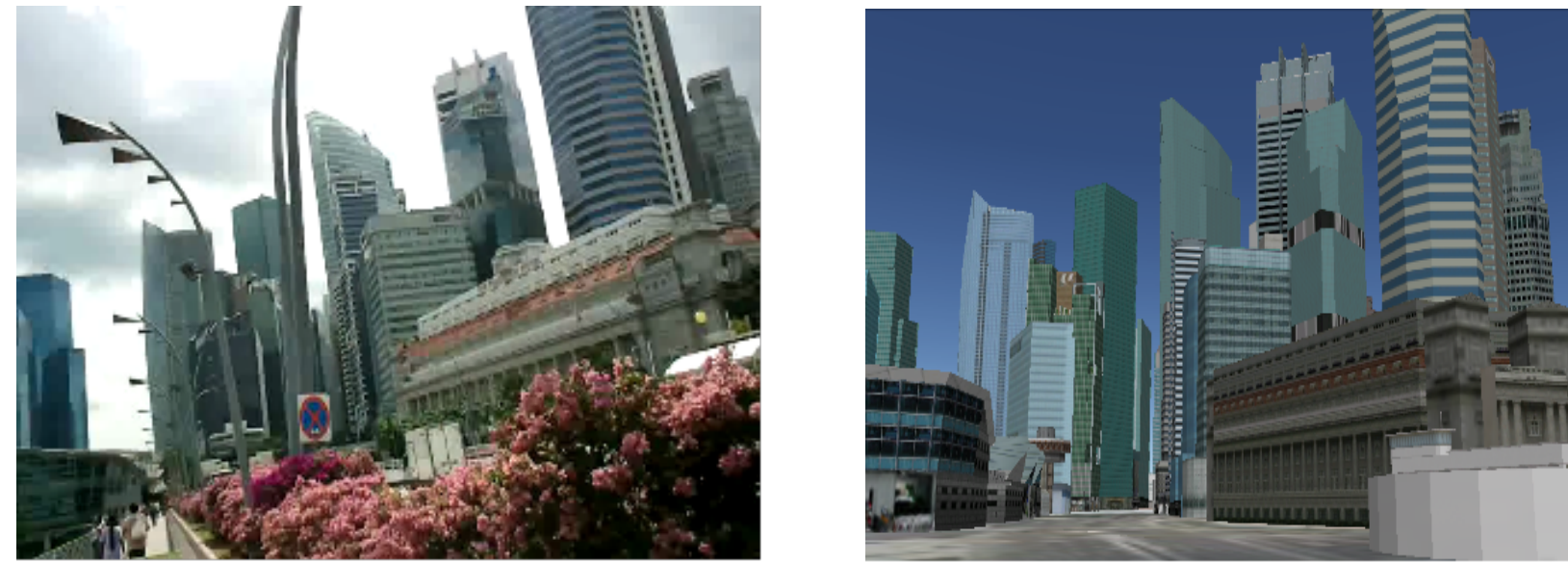
P <longitude,latitude>: camera location
$\theta$ : viewable angle
$\vec{d}$ : camera direction vector
R : visible distance

P <longitude,latitude,altitude>: camera location
$\theta, \phi$ : horizontal and vertical viewable angles
$\vec{d}$ : camera direction vector (in 3D)
R : visible distance

**Motivation**:
Keyword search support, tagging automation, ranking tag relevance, light-weight computation

**Essential idea:**

*FOVScene description is generated every f frames*
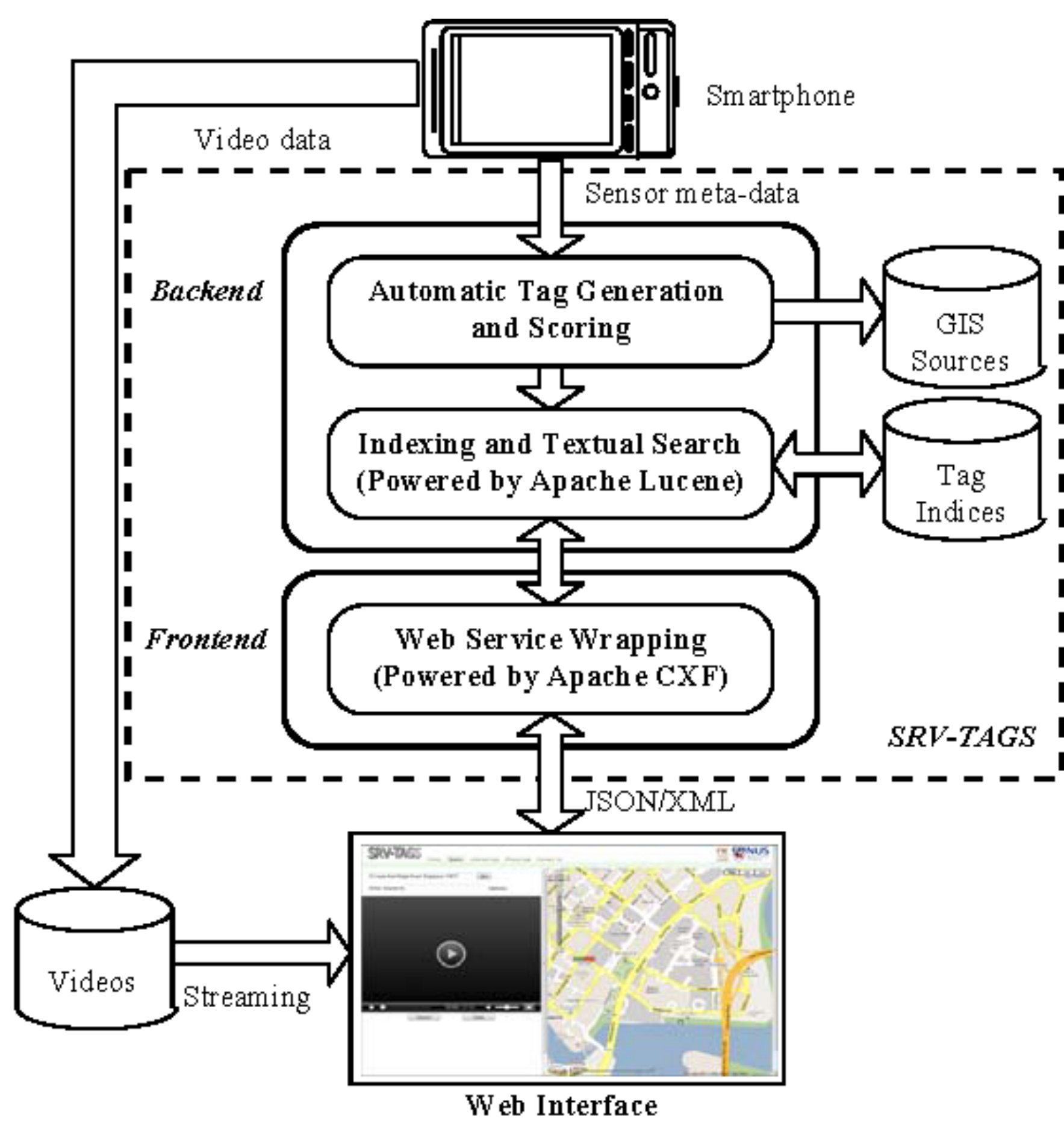
*USC, Tommy Trojan, Bovard Auditorium, Los Angeles*

**Geo-information systems:**
• Significant advance
• More comprehensive data
• Better usability
• Nicer simulation

## Methods and Prototype Implementation

### Framework

Smartphone
Video data
Sensor meta-data

Backend
Automatic Tag Generation and Scoring → GIS Sources

Indexing and Textual Search (Powered by Apache Lucene) → Tag Indices

Frontend
Web Service Wrapping (Powered by Apache CXF)

*SRV-TAGS*

JSON/XML

Videos → Streaming

Web Interface

### Core Functionality

**Visible geo-object recognition:**
• Using FOV to query objects from GIS
• Computing visibility and filtering occluded ones
  • Horizontal visibility
  • Vertical visibility
• Extracting textual description
• Repeating the process for each FoV

**Tag ranking:**
• Visual criteria
  • Closeness to the FoV center
  • Distance to the camera location
  • Visible angle range/percentage
• Social criteria
  • GIS (e.g., "landmark", "attraction")
  • Wikipedia reference

**Tag association:**
• Segmentation based on 0-score
• Integrating scores temporally

Esplanade — The Float — Marina Bay Sands
Score
Time
t0  t1 t2 t3  t4  t5 t6
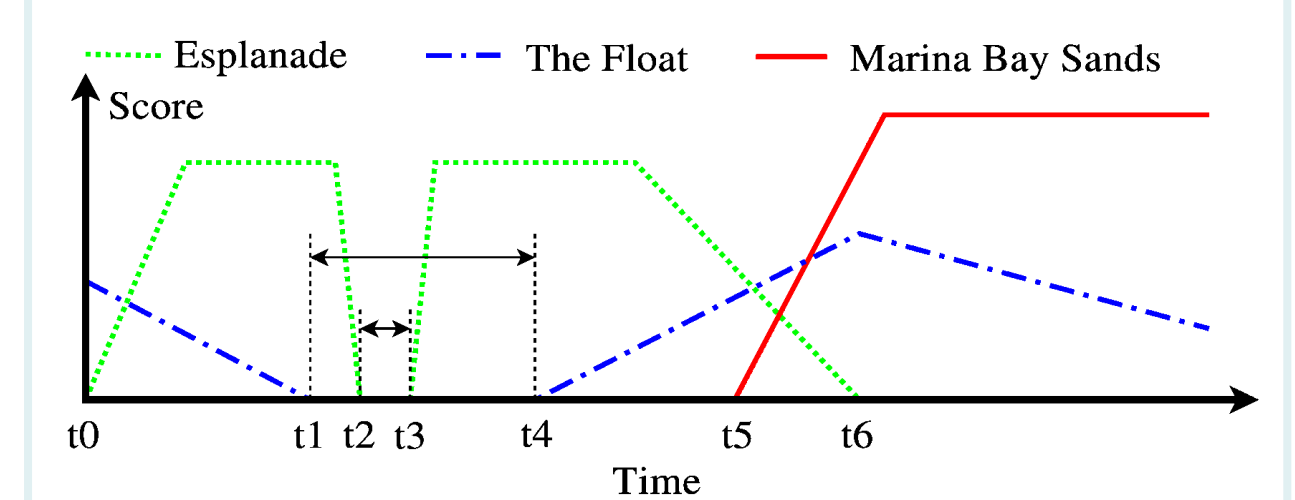
### Extension

**Textual Indexing and search support:** Apache Lucene
**Web service wrapping:** Apache CXF

## Experimental Results and Conclusion

**Video dataset:** 2 sites, 1 ~ 16 minutes
• Marina Bay Area of Singapore: 37 videos
• University of South California: 50 videos

**GIS:**
• OpenStreetMap: a open-source GIS
• GeoDec: 3D models of USC

**Result Highlights:**
• More higher quality tags
• Ranking consisting with human perception
• Tag association with exact video segment

(minutes) 0  1  2  3  4  5  6  7  8
1) Marina Bay
2) Marina Bay Sands
3) Esplanade
4) Singapore River
5) One Fullerton
6) Art Science Museum
7) Clifford Pier
8) Fullerton Hotel
9) Marina Bay Financial Ctr
10) Ocean Tower
11) HSBC building
12) Maybank Tower
13) NTUC Ctr
14) 50 Collyer Quay
15) One Raffles Quay

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15) One Raffles Quay
13) NTUC Ctr
10) Ocean Tower
14) 50 Collyer Quay
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12) Maybank Tower
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8) Fullerton Hotel
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Camera trajectory