# Spatialyze: A Geospatial Video Analytics System with Spatial-Aware Optimizations

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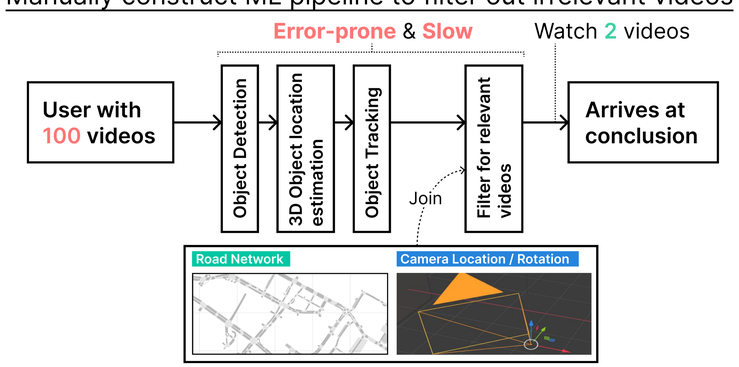
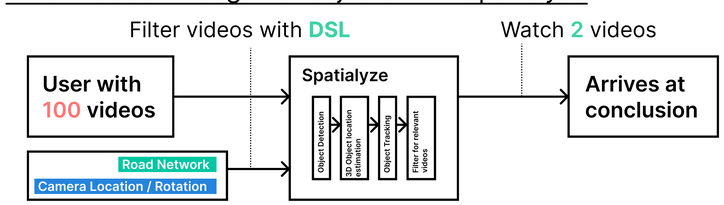
## # Geospatial Video Analytic Workflows

Manually Watching all videos

Manually construct ML pipeline to filter out irrelevant videos




Filter videos through 3D objects with Spatialyze

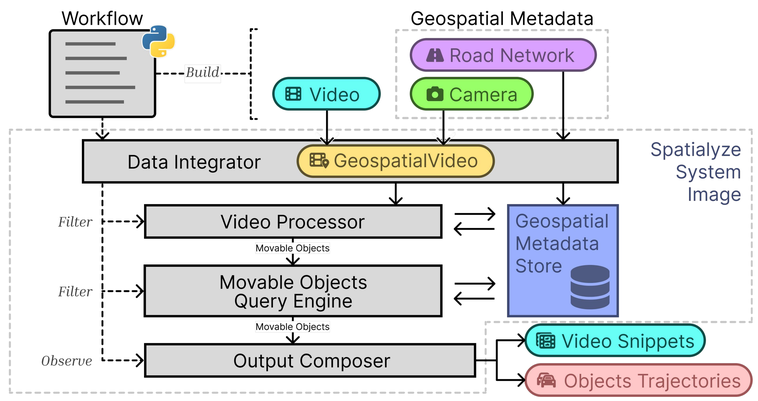



## # DSL for Geospatial Video Analytic

Spatialzye comes with a DSL for users to search for videos through 3D objects that exists in them.

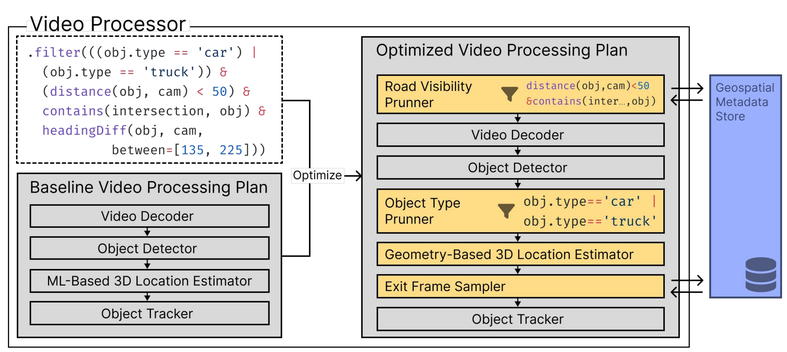
```
Spatialyze Example

world = World(database)
world.addGeogConstructs(RoadNetwork('Boston-Seaport', ROAD_DIR))

world.addVideo(GeospatialVideo(
  './data/boston-seaport-scene-0655-CAM_FRONT.mp4',
  './data/boston-seaport-scene-0655-CAM_FRONT.camera.pkl'
))

o = world.object()
c = world.camera()
world.filter((o.type == 'car') & F.contained(o, 'intersection'))

objects = world.saveVideos('./output_videos', addBoundingBoxes=True)
```

## # Spatialyze System




## # Video Processing Optimization

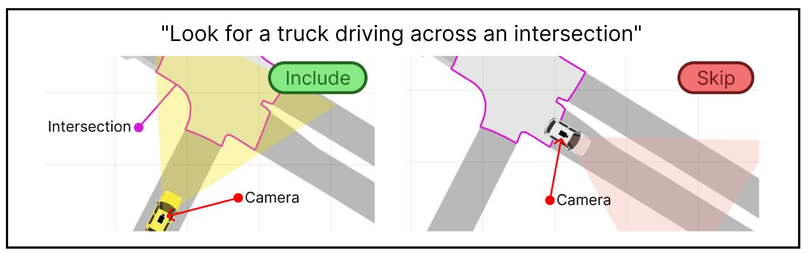
Spatialyze optimizes slow ML-based video processor based on users' queries and input geospatial metadata.




## # Optimization Techniques

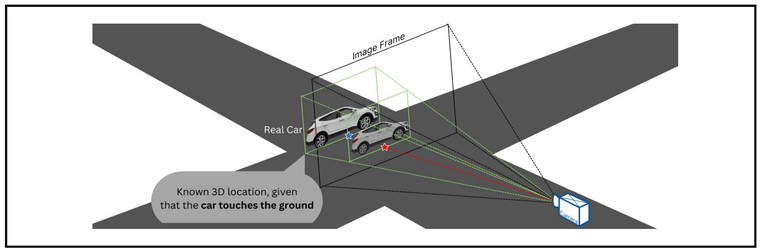
### o1 Road-Visibility Pruner

Use camera view to determine frames without the road type of interest



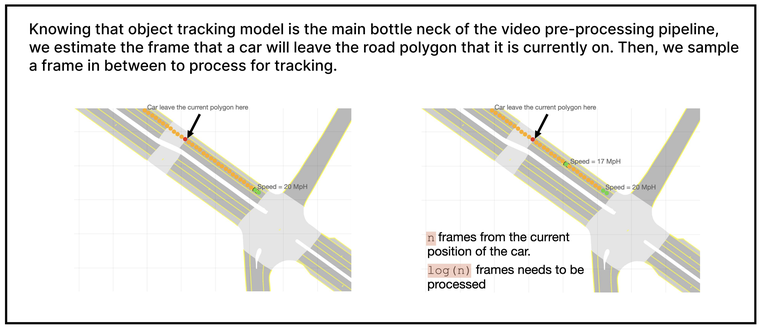

### o3 Geometry-based 3D location estimator

Assuming object of interest is at the ground level, use camera view to estimate the 3D location of the object.




### o4 Skip frames for object trackings

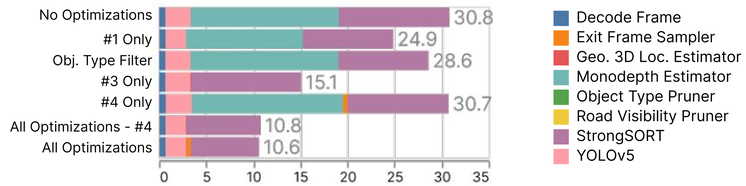
Assuming cars stay in the same lane when driving, reduces the frame rate for object tracking model.

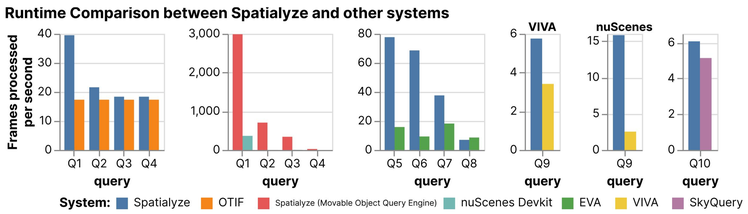



## # Runtime Results

Query (Q2): Find all frames where two cars in an intersection move in opposite directions.

Runtime Ablation Study




HOTA Association Accuracy: 83.4% Frame Output Accuracy: **99.22%**

**Runtime Comparison between Spatialyze and other systems**