Introduction

- **MediaQ**
  A novel online media management system to collect, organize, share, and search mobile images and videos using geo-tagged metadata of the multimedia content.

- **Metadata**
  W4-metadata per video frame:
  - **When**
    Time Stamp: Time at which video is taken
  - **Where**
    Camera Location: Latitude and Longitude of the camera
  - **View Direction**
    Angle of camera’s viewing direction w.r.t North
  - **What**
    Keys: Set of keywords tagged with the video
  - **Who**
    Faces: People and number of people in the video frame
  - **Motivation**
    The Multi-Dimensional metadata as defined above can be effectively analyzed and used using various visualization tools and techniques.

Motivation

- **Amount of Data**
  For a video of 2 min (120 seconds) with 30 frame/sec if the sampling speed is 1 frame/sec we get 120 frames. With thousands of such videos there will be a large number of metadata records to be visualized on the map. **Time-consuming** for processing

- **Shape of Metadata**
  The FOV is shaped as a sector of a circle and hence **complicated mathematical equations** arise for detecting overlapping sectors in a particular region

- **Various Query Parameters**
  Various search options (Region, Date and Keywords) provided by MediaQ makes the regions on the map **infeasible to pre-process for quick rendering**

- **Frequency of rendering visualization**
  As the user drags the map to discover new regions the visualization needs to be recomputed and updated thus **slowing down the system**

System Design

- **Grid Based Map**
  Simplify and speed up the computation of area covered by the video metadata by **dividing the map into virtual grid** and finding overlap of each FOV sector with underlying grid to identify grid cells covered in the video. **Decreasing grid cell size increases accuracy of area covered.**

- **Heat Map Representation**
  Color coded virtual grid for representing intensity (number) of videos in each region where color ranges from light blue to dark red representing low to high intensity.

- **Pre-Processing Metadata**
  While uploading the video pre-processing metadata speeds up the run-time computation and DB queries. **We identify the virtual grid cells overlapping with the FOV and insert it to the DB corresponding to its FOV.**

- **Inverted Indexing in DB**
  Processing number of videos per grid cell is costly if we store Video -> Grid Cell relation in the DB than storing Grid Cell -> Videos as a pre-processing step.

- **Different type of Visualizations**
  As the map supports different level of zoom, we can save on data processing by supporting different type of visualizations for far and close view. When zoomed out we can represent videos in a region by clustering rather (Shown in Fig2) than Heat Map on Grid (Shown in Fig3)

Conclusion and Future Work

- **Video Playing**
  - Corresponding metadata FOV on the map gives more insight about the direction and area viewed in the frame.
  - Lowest level of granularity represented by the FOV sector.

- **High Zoom Level (<10)**
  - Represented by individual pin for videos

- **Medium Zoom Level (>=10 & <16)**
  - Represented by colored coded heat map and clustering of videos in the close by region

- **Low Zoom Level (>=16 & <20)**
  - Represented only by clustering of video in the region
  - Saves computation and rendering for a large number of grid cells

**Fig1 Visualization of FOV (Video Playing)**

**Fig2 Visualization of Region Covered in medium zoom level**

**Fig3 Visualization of Number of Videos in the Region low zoom level**