Design of a Software Suite to Support Indexing, Annotating, and Analyzing Climbing Videos
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While capturing videos of sport performances is simple, retrieving a video requires an indexing system. Producing data that enable comparing athletes’ performances also requires adapted tools. We collaborated with the French climbing federation to build a software suite that indexes videos, enables to annotate them, and provides interactive means to visualize them.

### Metadata and videos

we retrieve or produce data from official events to link to videos captured to facilitate navigation and retrieval challenges include video sizes and format to upload on servers while attending official events

### Video indexation

**CHALLENGES**
- large quantities of data to store scattered across multiple devices
- ways to link videos with data from performances for quick retrieval
- tools for uploading videos in constraining contexts to centralize

**SOLUTIONS**
- dedicated server using MongoDB with constant maintenance, GDPR compliant
- 923 videos for a total of 43.7 hours and 72GB
- 42 competitions covered, for 1232 single performances, and 3 disciplines (speed, boulder, and lead climbing)

### Data production

**CHALLENGES**
- methods using image analysis still limited, so manual annotation required
- tedious task requiring manpower and funds to annotate all performances of competitions
- identifying significant factors to annotate to not waste time on unexploitable data

**SOLUTIONS**
- dedicated annotation tool for lead climbing to produce quantitative and qualitative data
- 498 annotated videos with in average 156 [150, 162] annotations per video
- 30.3 minutes [28.6, 32.1] in average for annotating performances

### Data analysis

**CHALLENGES**
- compare athletes’ data with themselves or others over whole seasons or competitions
- identify significant factors influencing the outcome of a performance
- identify the benefits of an analytical interactive tool

**SOLUTIONS**
- dashboards in Dashplotly designed in collaboration with the federation’s analysts
- support analysts to profile athletes and compare their performances
- study competition and season outcomes to adapt training programs

### 1. Search Query

<table>
<thead>
<tr>
<th>Player</th>
<th>Name</th>
<th>Competition</th>
<th>Date</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athlete 1</td>
<td>Name 1</td>
<td>Competition 1</td>
<td>Date 1</td>
<td>Result 1</td>
</tr>
<tr>
<td>Athlete 2</td>
<td>Name 2</td>
<td>Competition 2</td>
<td>Date 2</td>
<td>Result 2</td>
</tr>
<tr>
<td>Athlete 3</td>
<td>Name 3</td>
<td>Competition 3</td>
<td>Date 3</td>
<td>Result 3</td>
</tr>
</tbody>
</table>

### 2. Performances

<table>
<thead>
<tr>
<th>Athlete</th>
<th>Performance</th>
<th>Result</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athlete 4</td>
<td>Performance 4</td>
<td>Result 4</td>
<td>Notes 4</td>
</tr>
<tr>
<td>Athlete 5</td>
<td>Performance 5</td>
<td>Result 5</td>
<td>Notes 5</td>
</tr>
</tbody>
</table>

### 3. Video

- Video of athlete in action
- Visual representation of performance

### 4. Manual Annotations

- Annotations for each performance
- Data visualization

### 5. Data Analysis

- Statistical analysis graphs
- Progression over time
- Comparison of performances