Sports Summary Highlights using Artificial Intelligence

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IBM Sports and Entertainment

For more than 22 years, we have helped many of the world’s most preeminent Sports & Entertainment brands succeed and provide world-class digital experiences to customers around the world.
Sports Summary Highlight Videos – Traditional Approach

• Highlight template assets are created pre-tournament.
  • Graphics and Branding
  • Bumpers
  • Editing Suite Project Template
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<thead>
<tr>
<th>Point Quality Description</th>
<th>Point Winner</th>
<th>Points</th>
<th>Games</th>
<th>Net Approach</th>
<th>Set</th>
<th>Court</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Ace</td>
<td>Andrea Petkovic</td>
<td>0-0</td>
<td>0-0</td>
<td></td>
<td>1st Set</td>
<td>Deuce Court</td>
</tr>
<tr>
<td>3 Unforced Error</td>
<td>Jennifer Brady</td>
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<td>0-0</td>
<td></td>
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<td>1 Winner, Long Rally</td>
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<td>Andrea Petkovic</td>
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Editors search production footage for these points based on business rules and pull selected scenes into video editing suite.

Tennis Highlight Selection Business Rules:

- Always Show Match Point.
- Always Show Set Point.
- Show key moments in the match that helped determine the outcome.
- Show exciting and noteworthy points.
- Avoid negative play like unforced errors.
- Limit scene to 15 seconds of tennis action.
- Limit video to approximately 120 seconds of tennis action.
- Show the player reaction after the point is over.
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- Editing steps:
  - Scene in and out times
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  - Template updated in video editing suite with player names, scores, etc.
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- Publish
The Challenge

Cover as much video content as possible with automation and provide a fast, quality, comprehensive service covering ALL content.

Additionally, surface compelling individual moments for fans and the editorial staff.
Highlight Packages

Tennis:
- Match Summary Highlights
- Single Point SlamTracker Highlights
- Editorial Dashboard

Golf:
- Round in 3 Minute Highlights
- Single Shot Highlights
- Hole Highlights
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AI Highlight Coverage at the US Open:
- 7 courts
- Men’s and Women’s Singles
- 31,000 Video Scenes Analyzed
- 150 Highlight Packages Produced

AI Highlight Coverage at Wimbledon:
- 10 Courts
- All events
- 66,000 Video Scenes Analyzed
- 375 Highlight Packages Produced

AI Highlight Coverage at the Masters:
- 18 holes
- All Players
- 20,000 Video Scenes Analyzed
- 292 Highlight Packages Produced
Scene Changes

Rough cut video clip using scoring timing data.

Taking advantage of production patterns, video scenes are broken down into individual shots using scene change detection.

Thumbnails extracted from the first frame of each shot:
Watson Visual Recognition Training

2019 US Open Highlights
Associated Service: ai-highlights-visual-recognition

My classes (3)  All images (94)

Drag and drop files from your project.

3 classes | 0 incomplete classes | 0 unclassified images

New training data size: 0.7/250 MB

Create a class

Negative (36)
This class is recommended but not required.

Replay (29)

Tennis (29)
**Scene Change Detection**

Detect Scene Changes

```
"ffmpeg -nostats -threads 2 -i INPUTVIDEO.ts -max_muxing_queue_size 999 -filter:v 'select=gt(scene\,0.18),showinfo' -f null - 2>&1 | grep Parsed_showinfo_1"
```

Extract Images at those Scene Changes

```
"ffmpeg -loglevel panic -y -threads 2 -ss SECS -i INPUTVIDEO.ts -vframes 1 -q:v 1 -vf yadif THUMBNAIL.jpg"
```

Then post image to Watson Visual Recognition for Classification (Tennis, Replay or Negative):

```
curl --max-time 40 -sS -X POST -u "apikey:YOURAPIKEY" -F "images_file=@THUMBNAIL.jpg" -F "threshold=0.6" -F "classifier_ids=YOURCLASSIFIERNAME" "https://gateway.watsonplatform.net/visual-recognition/api/v3/classify?version=2018-03-19"
```
Watson Scene Classifications

Negative

Replay

Tennis

Negative

Negative

Negative
Clipped Scenes

Begin

End
Extraneous Moments in Clipped Scenes
Acoustic Adjustments to Tighten Scene Clipping

- IBM Maximo PQI Acoustic Insights.
- Primarily used to monitor the sounds of machinery in factories.
- For this project, trained on common tennis sounds:
  - Ball Strike
  - Shoe squeak on court
  - Applause
  - Chair Umpire
  - Ball Bounce
- Docker container running on IBM Cloud.

- Audio extracted from video and posted to API.
- Single JSON response with sound classifications and timing.
- Non-tennis content removed from clip.
Tighter Clipping using Audio Classifications
**Notable Scenes**

OK, but there were 182 points in that match, which ones were notable enough to put into a highlight reel?

Sound of the Crowd

You know, crowd noise. Not sound level but actual crowd noise.

Player Gestures

Visible analysis of end of the scene to determine if players are celebrating.

Tennis Analytics

Point quality ranking based on traditional tennis stats such as Break Points and Winners.
Match Highlight Editor
Selected Duration: 118 Seconds

Point Winner:
- Both
- S. Williams
- P. Martic

Serve Number:
- Both
- 1
- 2

Top 20%:
- None
- Excitement
- High Crowd Noise
- High Game Score
- Gesture
- Action Duration

Filter Points:
- Currently Selected
- Long Rallies
- Long Rallies+
- Winners
- Break Points
- Break Points Won
- Forced Errors
- Aces
- Replay
- Smash
- Volley
- Net Approaches

<table>
<thead>
<tr>
<th>Selection</th>
<th>Preview</th>
<th>Set</th>
<th>Point Number</th>
<th>Winner of Point</th>
<th>Points</th>
<th>Game</th>
<th>Server</th>
<th>Description</th>
<th>Length</th>
<th>Action</th>
<th>Crowd</th>
<th>Game</th>
<th>Gesture</th>
<th>Total Score</th>
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<td></td>
<td></td>
<td>1</td>
<td>28</td>
<td>1</td>
<td>15-40</td>
<td>2-1</td>
<td>P. Martic</td>
<td>Williams wins the point with a forehand winner.</td>
<td>15 sec</td>
<td>10 sec</td>
<td>0.77</td>
<td>0.55</td>
<td>0.48</td>
<td>0.82</td>
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<td>1</td>
<td>29</td>
<td>1</td>
<td>30-40</td>
<td>2-1</td>
<td>P. Martic</td>
<td>Williams wins the point with a forehand winner.</td>
<td>18 sec</td>
<td>13 sec</td>
<td>1</td>
<td>0.55</td>
<td>0.02</td>
<td>0.76</td>
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<tr>
<td></td>
<td></td>
<td>1</td>
<td>43</td>
<td>2</td>
<td>30-40</td>
<td>3-2</td>
<td>P. Martic</td>
<td>Matic wins the point with a backhand volley winner.</td>
<td>17 sec</td>
<td>15 sec</td>
<td>0.82</td>
<td>0.4</td>
<td>0.54</td>
<td>0.8</td>
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<tr>
<td></td>
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<td>1</td>
<td>59</td>
<td>1</td>
<td>AD-40</td>
<td>4-3</td>
<td>P. Martic</td>
<td>Break Point; Williams wins the point with a backhand winner.</td>
<td>20 sec</td>
<td>15 sec</td>
<td>0.74</td>
<td>0.85</td>
<td>0.01</td>
<td>0.76</td>
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<td></td>
<td>1</td>
<td>67</td>
<td>1</td>
<td>AD-40</td>
<td>5-3</td>
<td>S. Williams</td>
<td>Set Point; Williams wins the point with a forehand winner.</td>
<td>11 sec</td>
<td>6 sec</td>
<td>0.78</td>
<td>0.45</td>
<td>0.01</td>
<td>0.68</td>
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<td></td>
<td>2</td>
<td>78</td>
<td>2</td>
<td>0-15</td>
<td>1-1</td>
<td>P. Martic</td>
<td>Matic wins the point with a forehand volley winner.</td>
<td>16 sec</td>
<td>15 sec</td>
<td>0.86</td>
<td>0.55</td>
<td>0.18</td>
<td>0.76</td>
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<tr>
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<td>2</td>
<td>95</td>
<td>1</td>
<td>40-30</td>
<td>2-2</td>
<td>P. Martic</td>
<td>Break Point; Williams wins the point with a forehand volley winner.</td>
<td>18 sec</td>
<td>14 sec</td>
<td>1</td>
<td>0.9</td>
<td>0.03</td>
<td>0.84</td>
</tr>
</tbody>
</table>
Workflow
Dashboard

US Open AI Highlights

Taylor Townsend vs Sorana Cirstea
Set 1: 40-AD: Break Point; Cirstea wins the point with a backhand winner.

Overall Excitement:
- Crowd Cheering: 0.84
- Match Analysis: 0.85
- Player Gestures: 1.00
- Overall: 0.96

Most Exciting

1.00
Tuesday, August 27, 2019, 6:46 PM
Anastasia Potapova vs Coco Gauff
Point: Gauff wins the point with a drop volley winner.

0.96
Saturday, August 31, 2019, 11:29 AM
Taylor Townsend vs Sorana Cirstea
Set 1: 40-AD: Break Point; Cirstea wins the point with a backhand winner.

0.96
Wednesday, August 28, 2019, 7:35 PM
Novak Djokovic vs Juan Ignacio Londero

Produced Highlight

ROUND 4

FEDERER
GOFFIN

Additional Information

- [https://www.ibmbigdatahub.com/blog/how-ai-picks-most-exciting-moments-us-open-without-bias](https://www.ibmbigdatahub.com/blog/how-ai-picks-most-exciting-moments-us-open-without-bias)
- [https://www.youtube.com/watch?v=Bw9eIfike_s](https://www.youtube.com/watch?v=Bw9eIfike_s)
- [https://www.ibm.com/watson/media/highlights-clipping](https://www.ibm.com/watson/media/highlights-clipping)