Second Spectrum:
Major League Soccer – Tracking and Metadata Output Formats

File Documentation Details
Version 0.1

Version History

Version	Date	Notes
v0.1	8/14/19	Initial Version

Overview

Second Spectrum will deliver both metadata and tracks files .json and .jsonl formatting which is described below.

Output Format

Output	Format	Message Contents	Notes
METADATA	.json	Games, players, teams mappings	
TRACKING	Line-delimited .jsonl[1]	XYZ positions of ● Players (22) ● Ball ● Referee (only for MLS)	One message is generated **per frame** of input video.

[1]A line-delimited JSON file consists of
- one JSON message per line
- successive messages separated by a single linefeed ('\n').

Game Metadata

Metadata files in .json will be available in RestAPI format and other agreed upon upload locations per game.

Example Game Metadata Object in JSON

```
{
        "ssiId":"1dc5d461-a792-428c-bdbc-f68efdb48c78",
        "description":"BOU - NEW : 2019-3-16",
        "homeSsiId":"a8426f42-abc8-4224-a7b9-8df69a5b56a2",
        "awaySsiId":"3f8f4e99-4722-4925-bf42-54c55e4a4faa",
        "startTime":1552741200000,
        "year":2019,
        "month":3,
        "day":16,
        “venueId”: “8vnu2g41orfaa25n2djgrv4jm”,
        "fps": 25.0,
        "periods": [
          {
            "number": 1,
            "startFrameIdx": 1545836408396,
            "endFrameIdx": 1545839180356
          },
           … second half omitted …
        ],
        "homePlayers":[
                {
                        "ssiId": "2ab50ef5-7aec-4f57-b52f-f12aee300337",
                        "name": "D. Rico",
                        "number": "21"
                },

                   … other players omitted …
               ],
        "awayPlayers":[
                {
                        "ssiId":"00aa3b30-12a8-4163-9fed-fe58dc3bce8c",
                        "name":"D. Yedlin",
                        "number":"22"
                },
                   … other players omitted …
               ],
        "pitchLength":104.8512,
```

```
        "pitchWidth":67.9704
}
```

MLS Game Metadata Object

Field	Type	Description
ssiId	String	Second Spectrum Inc, game ID `"ssiId":"1dc5d461-a792-428c-bdbc-f68efdb48c78",`
description	String	{Home} - {Away} : YEAR-MONTH-DAY `"description": "BOU - WAT : 2019-1-2",`
homeSsiId	String	Second Spectrum Inc, ID for the home team `"homeSsiId": "1pse9ta7a45pi2w2grjim70ge",`
awaySsiId	String	Second Spectrum Inc, ID for the away team `"awaySsiId":"3f8f4e99-4722-4925-bf42-54c55e4a4faa",`
startTime	Int	Start time of the game, encoded as the number of milliseconds since January 1, 1970, GMT `"startTime": 1546462800000,`
year	Int	The game's year `"year": 2019,`
month	Int	The game's month `"month": 1,`
day	Int	The game's day `"day": 2,`

venueId	String	SSI venue Id `“venudId”: “8vnu2g41orfaa25n2djgrv4jm”,`
fps	Float (1/seconds)	Number of frames per second `"fps": 25.0,`
periods	JSON Array of period objects	Details on when the periods start and end in the tracks files `"periods": [ { "number": 1, "startFrameClock": 1545836408396, "endFrameClock": 1545839180356 }, … ],`
homePlayers	JSON Array of player objects	The home players on the roster for the match `"homePlayers": [ { "ssiId": "2ab50ef5-7aec-4f57-b52f-f12aee300337",, "name": "D. Rico", "number": "21" }, ... ],`
awayPlayers	JSON Array of player objects	The away players on the roster for the match `"awayPlayers": [ { "ssiId": "00aa3b30-12a8-4163-9fed-fe58dc3bce8c", "name": "D. Yedlin", "number": "22" }, ... ]`
pitchLength	Float	Length of the pitch

	(meters)	`"pitchLength":104.8512,`
pitchWidth	Float (meters)	Width of the pitch `"pitchWidth":67.9704`

Example period Object

```
{
  "number": 2,
  "startFrameClock": 1545840084636,
  "endFrameClock": 1545842967556
}
```

MLS period Metadata Object

Field	Type	Description
number	Int	Period number, 1 for the first half, 2 for the second half, 3 and 4 for extra time halves, and 5 for penalties `"number": 2,`
startFrameIdx	Int	Start timestamp of this period's frame, in milliseconds from UNIX epoch `"startFrameIdx": 1545840084636,`
endFrameIdx	Int	End timestamp of this period's frame, in milliseconds from UNIX epoch `"endFrameIdx": 1545842967556`

Example player Object

```
{
    "ssiId": "2ab50ef5-7aec-4f57-b52f-f12aee300337",
    "name": "D. Rico",
```

```
    "number": "21",
    “player”: “GK”
},
```

MLS player Metadata object

Field	Type	Description
ssiId	String	Second Spectrum Inc, player ID `"ssiId": "2ab50ef5-7aec-4f57-b52f-f12aee300337",`
name	String	Full name of the player `"name": "Asmir Begovic",`
number	Int	Jersey number of the player `"number": 27,`
position	String	Player position for this game `"position": "GK"`

Shared Object Fields

Message objects for the all tracking output share some common field that are defined below:

Field	Type	Description
frameIdx	Int	Frame index. Frame indices start at 0 at the beginning of the match and increment until the end of the match `"frameIdx": 11254`
period	Int	Period number, 1 for the first half, 2 for the second half, 3 and 4 for extra time halves, and 5 for penalties `"period": 1`
gameClock	Float (seconds)	Time since the start of the period `"gameClock": 719.34`

Tracking Output

Overview

The tracking file consists of a sequence of TrackingMessages containing the coordinates for

- Up to 22 players (11 home, 11 away)
- The ball

for all frames of a match. Frame exports will include a timestamp, encoded as the number of milliseconds since January 1, 1970, GMT. The timestamp will be provided by Second Spectrum's system server, which is synced to external world time via NTP.

Note: Tracking file will be available in .jsonl

Coordinate System

The coordinate system is a right-handed coordinate system with:

- the origin (0, 0, 0) at the center of the pitch
- X-axis running along the touch lines
- Y-axis running along the end lines
- Z-axis is vertical, with positive values above the pitch
- units in metres

Object Definitions

Example TrackingMessage[2] in JSON Line

```
{
  "period": 1,
  "frameIdx": 988,
  "gameClock": 39.52,
  "wClock": 1552761000000,
  "homePlayers": [
         {
             "playerId": "126184",
             "number": 10,
              "xyz": [48.77, 10.82, 0.0],
              "speed": 0.94,
         },
         {
             "playerId": "75115",
             "number": 18,
              "xyz": [16.09, 9.35, 0.0],
              "speed": 2.93
         },
         ...
  ],
  "awayPlayers": [
```

[2] The example message is formatted for easy reading. Actual output messages will not contain linefeeds or extra whitespace.

```
        {
            "playerId": "121599",
            "number": 6,
            "xyz": [15.8, 13.2, 0.0],
            "speed": 0.05
        },
        {
            "playerId": "38439",
            "number": 1,
            "xyz": [11.1, 6.15, 0.0],
            "speed": 5.35
        },
        ...
  ],
  "ball": {
            "xyz": [1.75, 0.7, 2.0],
            "speed": 12.85
   }
}
```

TrackingMessage Objects

Field	Type	Description
		Shared fields from Overview
homePlayers	JSON Array of Player Location objects	IDs and coordinates of home team players. Will have an item for each player on the pitch. `"homePlayers": [ { "playerId": "126184", "number": 10, "xyz": [48.77, 10.82, 0.0], "speed": 0.94 }, ... ],`

awayPlayers	JSON Array of Player Location objects	IDs and coordinates of away team players. Will have an item for each player on the pitch. `"awayPlayers": [ { "playerId": "121599", "number": 6, "xyz": [15.8, 13.2, 0.0], "speed": 0.05 }, ... ],`
ball	BallLocation object	3D location and speed of the ball. If the ball is not visible in the tracking area, this will be null (“`null`”). `"ball": { "xyz": [1.75, 0.7, 2.0], "speed": 12.85 }`

PlayerLocation Objects

Field	Type	Description
playerId	String	SSI Player ID `"playerId": ""`
number	Int	Player jersey number `"number": 10`
xyz	JSON Array of 3 Floats (metres)	Location of the player. For players z (height) is always zero `"xyz": [ 17.16, 14.12,  0 ]`

speed	Float (metres/second)	Instantaneous speed of the player `"speed": 5.35`

BallLocation Objects

Field	Type	Description
xyz	JSON Array of 3 Floats (metres)	Location of the ball `"xyz": [1.75, 0.7, 2.0],`
speed	Float (metres/second)	Instantaneous speed of the ball `"speed": 12.85`