CS322: Big Data

Final Class Project Report

Project (FPL Analytics / YACS coding): **FPL Analytics**   Date: **01/12/2020**

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INTRODUCTION

In this project, our task is to analyze the events occurring during football matches of the English Premier League (EPL). The matches are streamed using Streaming Spark and the events of each match (passes, fouls, goals, shots, duels) are processed. One batch of data is a match and all the events that took place in the match. Different player metrics (pass accuracy, free kick effectiveness, shots on target, duel efficiency, fouls and own goals) are calculated for every match and depending on these metrics, the player ratings and chemistry between the players are updated. Once all the matches are streamed, the user interface tasks (extracting player information, displaying match details and predicting winning chances for a match between any two given teams) are processed.
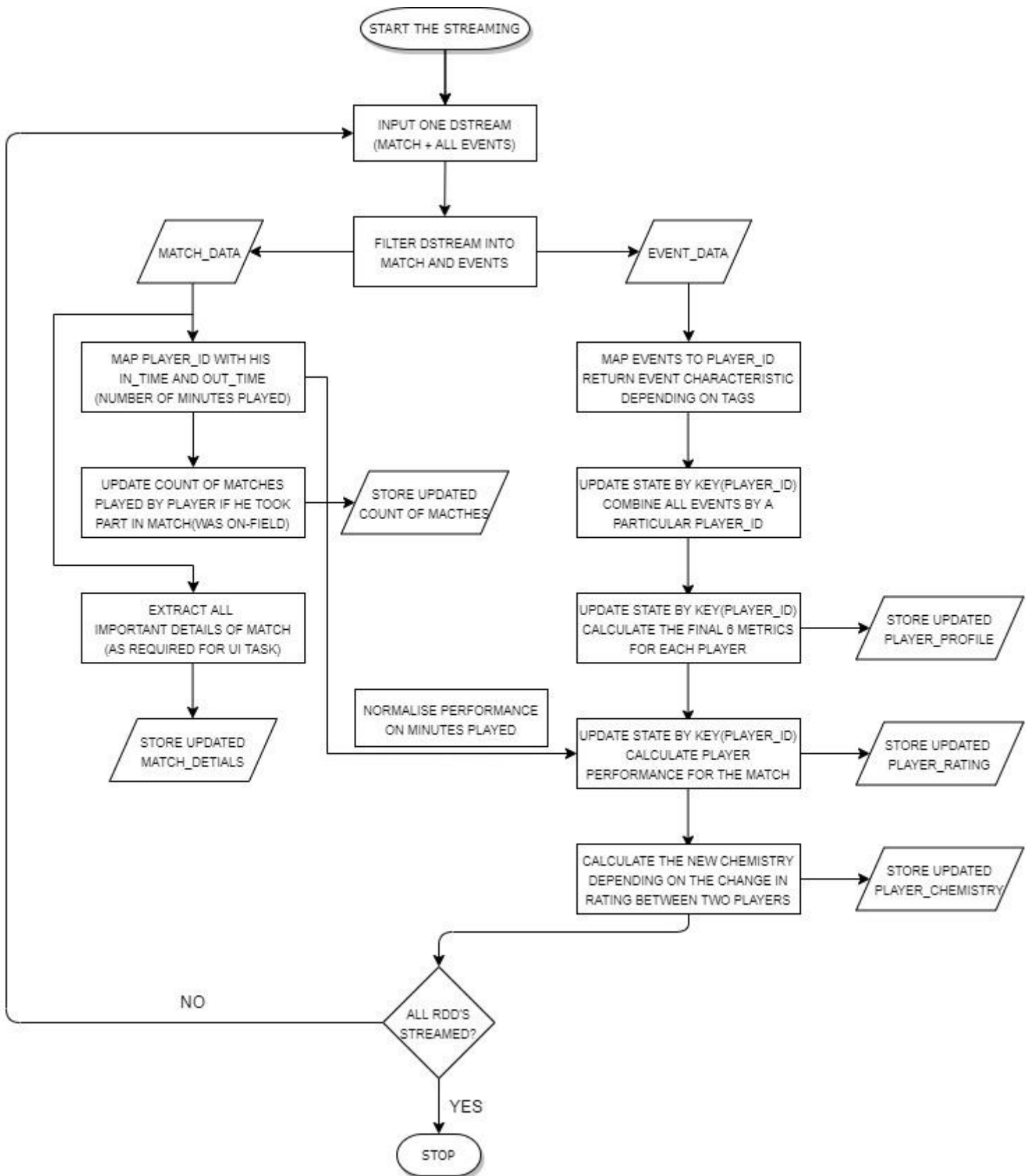
RELATED WORK

In order to complete this project,

- Watched the video lectures and slides given by Dr. KVS for the big data course.
- Used PESU Forums which we found very helpful to resolve our doubts immediately.
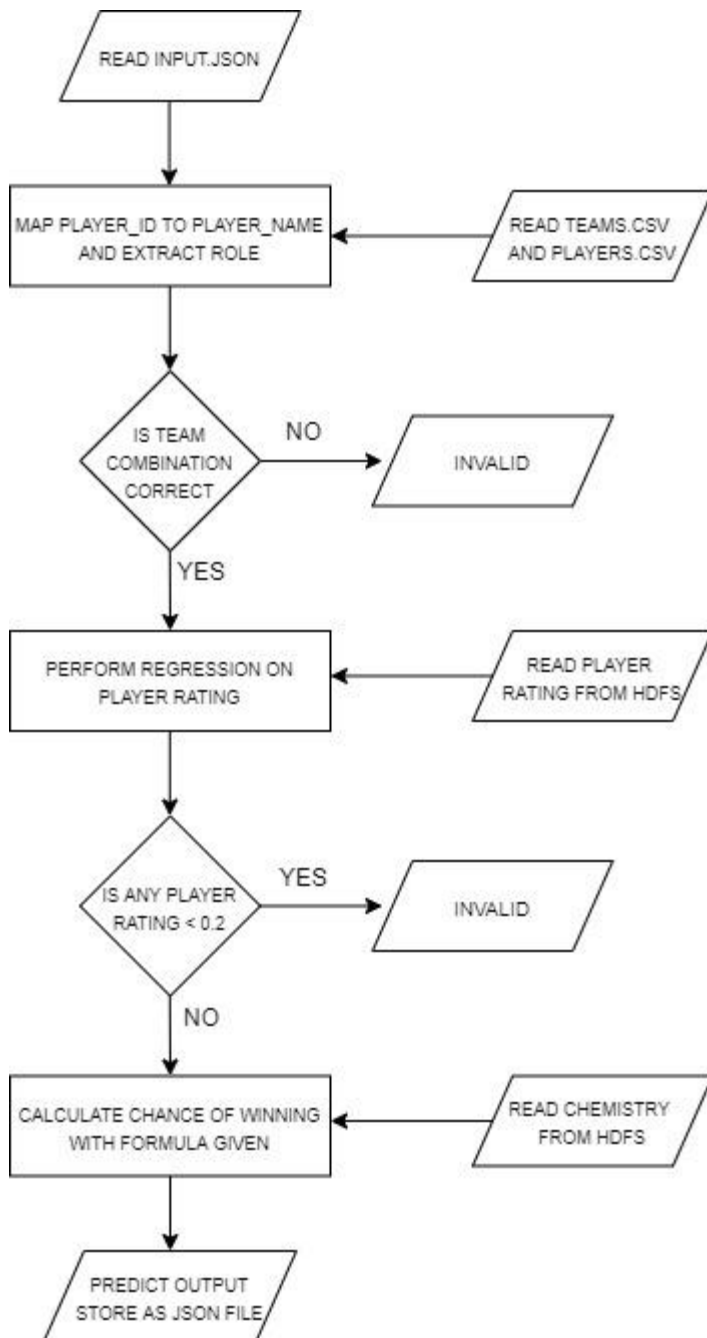- Went through the documentation of Apache Spark and Spark Streaming.

DESIGN
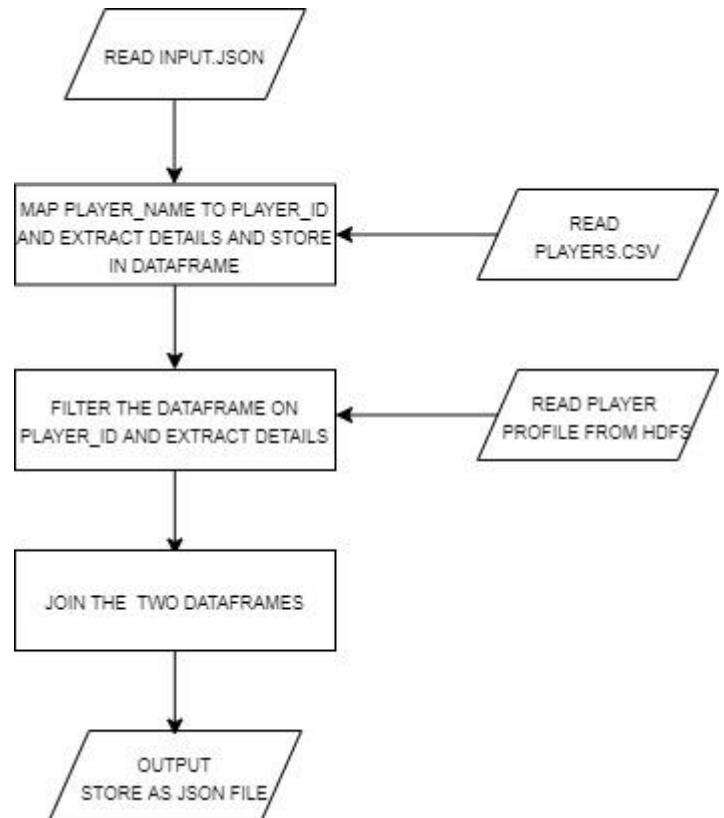
Our code is divided into 3 files

- **metrics.py:**
  To perform the streaming of data and calculating the player metrics, their performance for the match, updating their ratings and chemistry, processing match details and storing necessary states in hdfs.

- **main.py:**
  Machine Learning Tasks Clustering and Regression are performed here using ML Libraries

- **ui.py:**
  The three user interface tasks (extracting player information, displaying match details and predicting winning chances for a match between any two given teams) are performed here
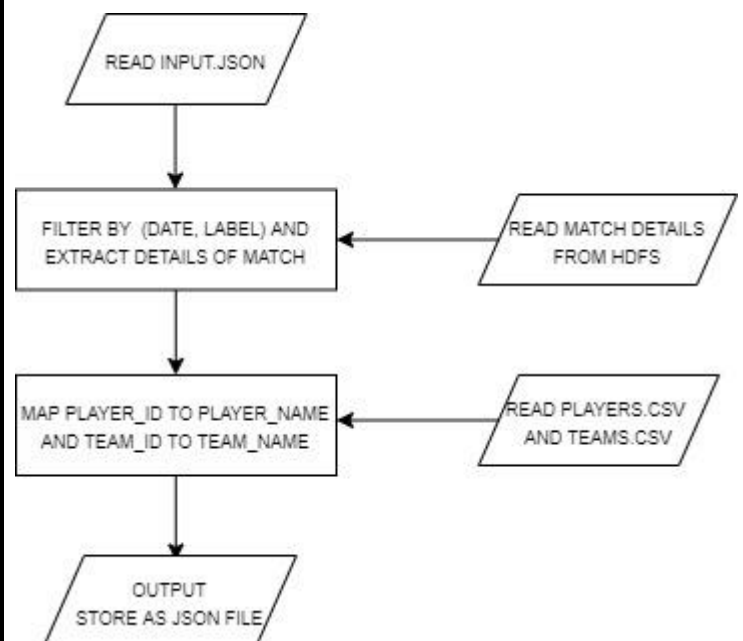
```
                        ┌─────────────────────┐
                        │  START THE STREAMING │
                        └─────────────────────┘
                                   │
                                   ▼
                        ┌─────────────────────┐
                        │  INPUT ONE DSTREAM   │
                        │ (MATCH + ALL EVENTS) │
                        └─────────────────────┘
                                   │
                                   ▼
                        ┌─────────────────────┐
       MATCH_DATA ◄─────│ FILTER DSTREAM INTO  │─────► EVENT_DATA
                        │  MATCH AND EVENTS    │
                        └─────────────────────┘
```

- START THE STREAMING
- INPUT ONE DSTREAM (MATCH + ALL EVENTS)
- FILTER DSTREAM INTO MATCH AND EVENTS
- MATCH_DATA
- EVENT_DATA
- MAP PLAYER_ID WITH HIS IN_TIME AND OUT_TIME (NUMBER OF MINUTES PLAYED)
- MAP EVENTS TO PLAYER_ID RETURN EVENT CHARACTERISTIC DEPENDING ON TAGS
- UPDATE COUNT OF MATCHES PLAYED BY PLAYER IF HE TOOK PART IN MATCH(WAS ON-FIELD)
- STORE UPDATED COUNT OF MACTHES
- UPDATE STATE BY KEY(PLAYER_ID) COMBINE ALL EVENTS BY A PARTICULAR PLAYER_ID
- EXTRACT ALL IMPORTANT DETAILS OF MATCH (AS REQUIRED FOR UI TASK)
- UPDATE STATE BY KEY(PLAYER_ID) CALCULATE THE FINAL 6 METRICS FOR EACH PLAYER
- STORE UPDATED PLAYER_PROFILE
- STORE UPDATED MATCH_DETIALS
- NORMALISE PERFORMANCE ON MINUTES PLAYED
- UPDATE STATE BY KEY(PLAYER_ID) CALCULATE PLAYER PERFORMANCE FOR THE MATCH
- STORE UPDATED PLAYER_RATING
- CALCULATE THE NEW CHEMISTRY DEPENDING ON THE CHANGE IN RATING BETWEEN TWO PLAYERS
- STORE UPDATED PLAYER_CHEMISTRY
- NO
- ALL RDD'S STREAMED?
- YES
- STOP

READ INPUT.JSON

MAP PLAYER_ID TO PLAYER_NAME AND EXTRACT ROLE

READ TEAMS.CSV AND PLAYERS.CSV

IS TEAM COMBINATION CORRECT

NO → INVALID

YES

PERFORM REGRESSION ON PLAYER RATING

READ PLAYER RATING FROM HDFS

IS ANY PLAYER RATING < 0.2

YES → INVALID

NO

CALCULATE CHANCE OF WINNING WITH FORMULA GIVEN

READ CHEMISTRY FROM HDFS

PREDICT OUTPUT STORE AS JSON FILE

PREDICTING MATCH WINNING CHANCES

READ INPUT.JSON

MAP PLAYER_NAME TO PLAYER_ID AND EXTRACT DETAILS AND STORE IN DATAFRAME

READ PLAYERS.CSV

FILTER THE DATAFRAME ON PLAYER_ID AND EXTRACT DETAILS

READ PLAYER PROFILE FROM HDFS

JOIN THE TWO DATAFRAMES

OUTPUT STORE AS JSON FILE

PLAYER PROFILE

READ INPUT.JSON

FILTER BY (DATE, LABEL) AND EXTRACT DETAILS OF MATCH

READ MATCH DETAILS FROM HDFS

MAP PLAYER_ID TO PLAYER_NAME AND TEAM_ID TO TEAM_NAME

READ PLAYERS.CSV AND TEAMS.CSV

OUTPUT STORE AS JSON FILE

MATCH INFO

RESULTS

We have added all the D Streams we generated during the streaming as well as the DAG.

STREAMING STATISTICS

Streaming Statistics

Running batches of **5 seconds** for **14 minutes 12 seconds** since **2020/12/03 17:15:06** (**167** completed batches, **283130** records)
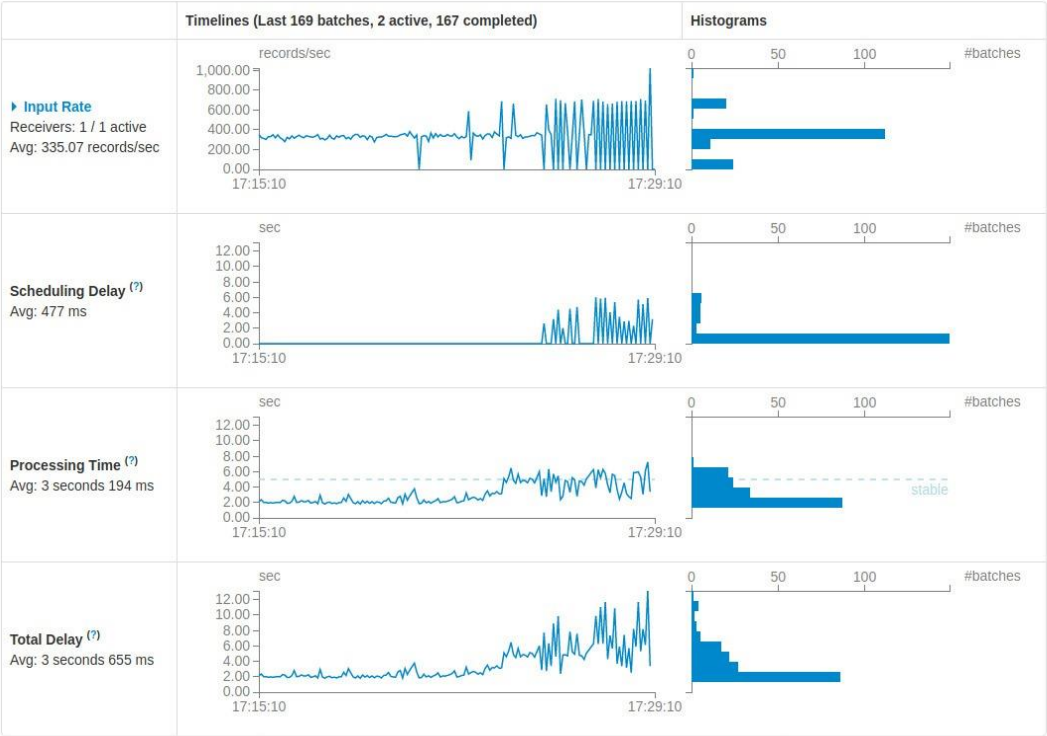
DAG'S
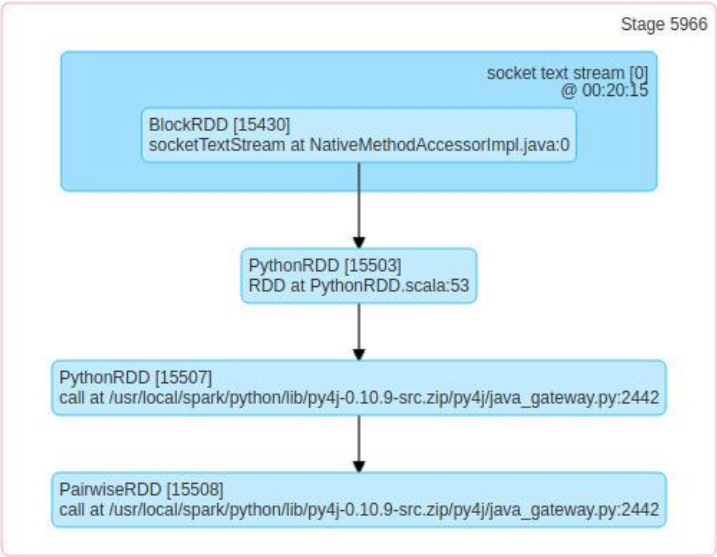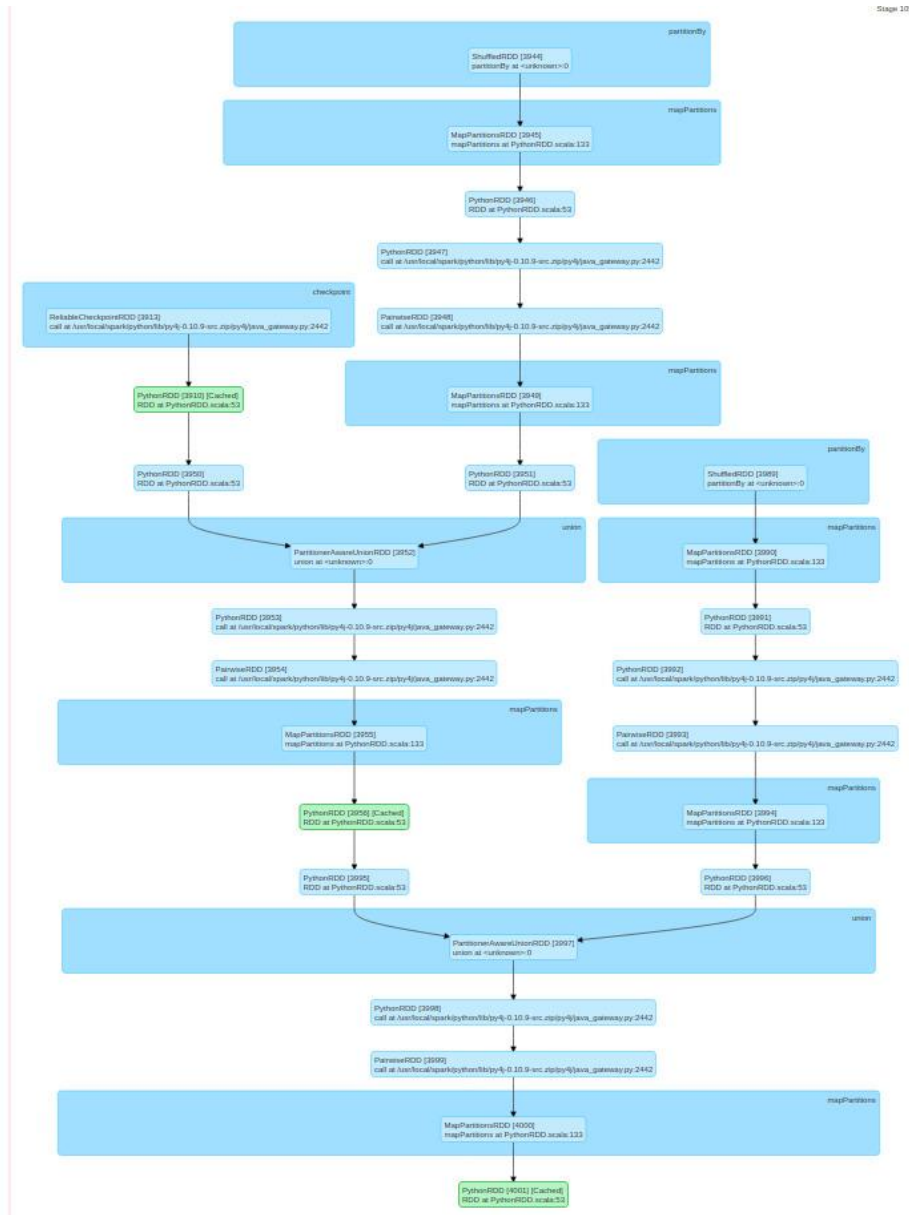
DTSREAMS GENERATED:

Time: 2020-12-08 13:23:55

{"status": "Played", "roundId": 4405654, "gameweek": 1, "teamsData": {"1609": {"scoreET": 0, "coachId": 7845, "side": "home", "teamId": 1609, "score": 4, "scoreP": 0, "hasFormation": 1, "formation": {"bench": [{"playerId": 20612, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 25662, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 7864, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 230020, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 26010, "ownGoals": "0", "redCards": "0", "goals": "1", "yellowCards": "0"}, {"playerId": 7879, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 7870, "ownGoals": "0", "redCards": "0", "goals": "1", "yellowCards": "0"}], "lineup": [{"playerId": 370224, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 120339, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 7945, "ownGoals": "0", "redCards": "0", "goals": "1", "yellowCards": "0"}, {"playerId": 14869, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 25413, "ownGoals": "0", "redCards": "0", "goals": "1", "yellowCards": "0"}, {"playerId": 7868, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 3560, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 167145, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 3319, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 7882, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 49876, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}], "substitutions": [{"playerIn": 26010, "playerOut": 370224, "minute": 67}, {"playerIn": 7870, "playerOut": 120339, "minute": 67}, {"playerIn": 7879, "playerOut": 7945, "minute": 75}]}, "scoreHT": 2}, "1631": {"scoreET": 0, "coachId": 333782, "side": "away", "teamId": 1631, "score": 3, "scoreP": 0, "hasFormation": 1, "formation": {"bench": [{"playerId": 119630, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 8498, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 8653, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 350976, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 8066, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 285508, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 217078, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 283142, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}], "lineup": [{"playerId": 14763, "ownGoals": "0", "redCards": "0", "goals": "1", "yellowCards": "0"}, {"playerId": 192748, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 8013, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 8480, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 149019, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 8488, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "94"}, {"playerId": 14853, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 265366, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}, {"playerId": 12829, "ownGoals": "0", "redCards": "0", "goals": "2", "yellowCards": "0"}, {"playerId": 26150, "ownGoals": "0", "redCards": "0", "goals": "0", "yellowCards": "0"}], "substitutions": [{"playerIn": 217078, "playerOut": 14763, "minute": 72}, {"playerIn": 285508, "playerOut": 192748, "minute": 82}, {"playerIn": 283142, "playerOut": 8013, "minute": 88}]}, "scoreHT": 2}}, "seasonId": 181150, "dateutc": "2017-08-11 18:45:00", "winner": 1609, "venue": "Emirates Stadium", "wyId": 2499719, "label": "Arsenal - Leicester City, 4 - 3", "date": "August 11, 2017 at 8:45:00 PM GMT+2", "referees": [{"refereeId": 385909, "role": "referee"}, {"refereeId": 385917, "role": "firstAssistant"}, {"refereeId": 384889, "role": "secondAssistant"}, {"refereeId": 381853, "role": "fourthOfficial"}], "duration": "Regular", "competitionId": 364}

MATCH DATA

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Time: 2020-12-08 13:23:55
------------------------------------------
{"eventId": 8, "subEventName": "Simple pass", "tags": [{"id": 1801}], "playerId": 25413, "positions":
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{"eventId": 8, "subEventName": "High pass", "tags": [{"id": 1801}], "playerId": 370224, "positions": [
tchPeriod": "1H", "eventSec": 4.946850000000012, "subEventId": 83, "id": 177959172}
{"eventId": 8, "subEventName": "Head pass", "tags": [{"id": 1801}], "playerId": 3319, "positions": [{"
hPeriod": "1H", "eventSec": 6.54218800000001, "subEventId": 82, "id": 177959173}
{"eventId": 8, "subEventName": "Head pass", "tags": [{"id": 1801}], "playerId": 120339, "positions": [
tchPeriod": "1H", "eventSec": 8.143394999999998, "subEventId": 82, "id": 177959174}
```

```
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  [{"y": 78, "x": 31}, {"y": 75, "x": 51}], "matchId": 2499719, "eventName": "Pass", "teamId": 1609, "ma

  ["y": 75, "x": 51}, {"y": 71, "x": 35}], "matchId": 2499719, "eventName": "Pass", "teamId": 1609, "matc

  [{"y": 71, "x": 35}, {"y": 95, "x": 41}], "matchId": 2499719, "eventName": "Pass", "teamId": 1609, "ma
```

EVENT DATA

```
------------------------------------------
Time: 2020-12-08 13:23:55
------------------------------------------
(25413, ((25413, 2499719, 1609), (1, 0, 0, 0), (0, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(370224, ((370224, 2499719, 1609), (1, 0, 0, 0), (0, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(3319, ((3319, 2499719, 1609), (1, 0, 0, 0), (0, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(120339, ((120339, 2499719, 1609), (1, 0, 0, 0), (0, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(167145, ((167145, 2499719, 1609), (1, 0, 0, 0), (0, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(3319, ((3319, 2499719, 1609), (0, 1, 0, 0), (0, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(8653, ((8653, 2499719, 1631), (1, 0, 0, 0), (0, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(8013, ((8013, 2499719, 1631), (0, 0, 0, 0), (1, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(0, ((0, 2499719, 1609), (0, 0, 0, 0), (0, 1, 0), (0, 0, 0), (0, 0, 0), 0, 0))
(167145, ((167145, 2499719, 1609), (1, 0, 0, 0), (0, 0, 0), (0, 0, 0), (0, 0, 0), 0, 0))
...
```

```
------------------------------------------
Time: 2020-12-08 13:23:55
------------------------------------------
(370224, ((370224, 2499719, 1609), (47, 12, 0, 0), (3, 2, 8), (2, 0, 0), (0, 0, 0), 2, 0))
(0, ((0, 2499719, 1631), (0, 0, 0, 0), (24, 22, 26), (8, 0, 0), (0, 0, 0), 0, 0))
(3560, ((3560, 2499719, 1609), (56, 2, 0, 0), (7, 3, 7), (0, 0, 0), (0, 0, 0), 0, 0))
(8488, ((8488, 2499719, 1631), (16, 1, 0, 0), (12, 2, 6), (0, 0, 0), (0, 0, 0), 4, 0))
(8480, ((8480, 2499719, 1631), (9, 4, 0, 0), (0, 0, 0), (9, 3, 0), (0, 0, 0), 0, 0))
(167145, ((167145, 2499719, 1609), (51, 5, 0, 0), (8, 7, 6), (4, 2, 0), (1, 0, 0), 1, 0))
```

```
------------------------------------------
Time: 2020-12-08 13:23:55
------------------------------------------
(370224, ((370224, 2499719, 1609), (0.7966101694915254, 0.6923076923076923, 1.0, 0.0, 2, 0, 0)))
(0, ((0, 2499719, 1631), (0.0, 0.5138888888888888, 1.0, 0.0, 0, 0, 0)))
(3560, ((3560, 2499719, 1609), (0.9655172413793104, 0.5, 0.0, 0.0, 0, 0, 0)))
(8488, ((8488, 2499719, 1631), (0.9411764705882353, 0.35, 0.0, 0.0, 4, 0, 0)))
(8480, ((8480, 2499719, 1631), (0.6923076923076923, 0.0, 0.75, 0.0, 0, 0, 0)))
(167145, ((167145, 2499719, 1609), (0.9107142857142857, 0.4523809523809524, 0.6666666666666666, 0.5, 1, 0, 0)))
(7945, ((7945, 2499719, 1609), (0.8095238095238095, 0.5263157894736842, 0.0, 0.25, 1, 0, 1)))
(7882, ((7882, 2499719, 1609), (0.9166666666666666, 0.5, 1.0, 0.0, 0, 0, 0)))
(26010, ((26010, 2499719, 1609), (1.0, 0.3125, 0.0, 0.5, 0, 0, 1)))
(120339, ((120339, 2499719, 1609), (0.9264705882352942, 0.5357142857142857, 0.0, 0.0, 0, 0, 0)))
...
```

FINAL METRICS

```
----------------------------------------
Time: 2020-12-08 13:23:55
----------------------------------------
(8480, (8480, 0))
(8488, (8488, 0))
(14763, (14763, 0))
(149019, (149019, 0))
(192748, (192748, 0))
(285508, (285508, 0))
(8013, (8013, 0))
(8653, (8653, 0))
(14853, (14853, 0))
(12829, (12829, 0))
...
```

MATCHES PLAYED

```
----------------------------------------
Time: 2020-12-08 13:23:55
----------------------------------------
(14763, (0, 72, 72, 14763))
(192748, (0, 82, 82, 192748))
(8013, (0, 88, 88, 8013))
(8480, (0, 90, 90, 8480))
(8653, (0, 90, 90, 8653))
(149019, (0, 90, 90, 149019))
(8488, (0, 90, 90, 8488))
(14853, (0, 90, 90, 14853))
(265366, (0, 90, 90, 265366))
(12829, (0, 90, 90, 12829))
...
```

MINUTES_PLAYED

```
----------------------------------------
Time: 2020-12-08 13:23:55
----------------------------------------
(8488, (((8488, 2499719, 1631), (0.9411764705882353, 0.35, 0.0, 0.0, 4, 0, 0)), (0, 90, 90, 8488)))
(8480, (((8480, 2499719, 1631), (0.6923076923076923, 0.0, 0.75, 0.0, 0, 0, 0)), (0, 90, 90, 8480)))
(14763, (((14763, 2499719, 1631), (0.6, 0.3888888888888889, 0.0, 0.3333333333333333, 3, 0, 1)), (0, 72, 72, 14763)))
(149019, (((149019, 2499719, 1631), (0.6153846153846154, 0.3888888888888889, 1.0, 0.0, 0, 0, 0)), (0, 90, 90, 149019)))
(192748, (((192748, 2499719, 1631), (0.8, 0.30434782608695654, 0.0, 0.0, 3, 0, 0)), (0, 82, 82, 192748)))
(285508, (((285508, 2499719, 1631), (0.5, 0.0, 0.0, 0.0, 0, 0, 0)), (82, 90, 8, 285508)))
(8653, (((8653, 2499719, 1631), (0.9565217391304348, 0.58, 0.0, 0.0, 1, 0, 0)), (0, 90, 90, 8653)))
(8013, (((8013, 2499719, 1631), (0.6363636363636364, 0.3611111111111111, 1.0, 0.0, 0, 0, 0)), (0, 88, 88, 8013)))
(14853, (((14853, 2499719, 1631), (0.6363636363636364, 0.4722222222222222, 0.8125, 0.0, 0, 0, 0)), (0, 90, 90, 14853)))
(12829, (((12829, 2499719, 1631), (0.7777777777777778, 0.37037037037037035, 0.0, 0.5, 0, 0, 2)), (0, 90, 90, 12829)))
...
```

FINAL PLAYER DETAILS FOR EVERY MATCH (6 METRICS AND TIME PLAYED)

```
----------------------------------------
Time: 2020-12-08 13:23:55
----------------------------------------
(8488, (8488, 0.41946691176470585, -0.08053308823529415, 1631))
(8480, (8480, 0.4393028846153846, -0.06069711538461542, 1631))
(14763, (14763, 0.38222222222222224, -0.11777777777777776, 1631))
(149019, (149019, 0.5130608974358974, 0.013060897435897445, 1631))
(192748, (192748, 0.37577294685990337, -0.12422705314009663, 1631))
(285508, (285508, 0.25555555555555554, -0.24444444444444446, 1631))
(8653, (8653, 0.45166847826086953, -0.04833152173913047, 1631))
(8013, (8013, 0.4941358024691358, -0.005864197530864201, 1631))
(14853, (14853, 0.502142518939394, 0.002142518939393989, 1631))
(12829, (12829, 0.46631944444444445, -0.03368055555555555, 1631))
...
```

PLAYER RATING (UPDATED VALUE, CHANGE FROM PREVIOUS)

```
-----------------------------------------
Time: 2020-12-08 13:23:55
-----------------------------------------
(370224, (370224, 2, 0, 0, 0.7966101694915254, 0.0))
(0, (0, 0, 0, 0, 0.0, 0.0))
(3560, (3560, 0, 0, 0, 0.9655172413793104, 0.0))
(8488, (8488, 4, 0, 0, 0.9411764705882353, 0.0))
(8480, (8480, 0, 0, 0, 0.6923076923076923, 0.0))
(167145, (167145, 1, 0, 0, 0.9107142857142857, 0.5))
(7945, (7945, 1, 1, 0, 0.8095238095238095, 0.25))
(7882, (7882, 0, 0, 0, 0.9166666666666666, 0.0))
(26010, (26010, 0, 1, 0, 1.0, 0.5))
(120339, (120339, 0, 0, 0, 0.9264705882352942, 0.0))
```

PLAYER_PROFILE

```
.........................................
Time: 2020-12-08 13:23:55
.........................................
(('2017-08-11', 'Arsenal - Leicester City, 4 - 3'), {'date': '2017-08-11', 'label': 'Arsenal - Leicester City, 4 - 3', 'duration': 'Regular', 'winner': 1609, 'venue': 'Emirates Stadium', 'gameweek': 1, '
yellow_cards': [8488], 'red_cards': [], 'own_goals': [[119630, '1631', 0], [8498, '1631', 0], [350976, '1631', 0], [8066, '1631', 0], [285508, '1631', 0], [217078, '1631', 0], [283142, '1631', 0], [14763
, '1631', 0], [192748, '1631', 0], [8013, '1631', 0], [8480, '1631', 0], [8653, '1631', 0], [149019, '1631', 0], [8488, '1631', 0], [14853, '1631', 0], [265366, '1631', 0], [12829, '1631', 0], [26150, '1
631', 0]], 'goals': [[26010, '1609', 1], [7870, '1609', 1], [7945, '1609', 1], [25413, '1609', 1], [119630, '1631', 0], [8498, '1631', 0], [350976, '1631', 0], [8066, '1631', 0], [285508, '1631', 0], [21
7078, '1631', 0], [283142, '1631', 0], [14763, '1631', 1], [192748, '1631', 0], [8013, '1631', 0], [8480, '1631', 0], [8653, '1631', 0], [149019, '1631', 0], [8488, '1631', 0], [14853, '1631', 0], [26536
6, '1631', 0], [12829, '1631', 2], [26150, '1631', 0]]})
```

MATCH DETAILS

Browse Directory

| /user/arshgoyal | Go! |

Show 25 entries   Search:

		Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name	
☐		drwxr-xr-x	arshgoyal	supergroup	0 B	Dec 08 13:24	0	0 B	Checkpointing_done	🗑
☐		drwxr-xr-x	arshgoyal	supergroup	0 B	Dec 08 13:24	0	0 B	Count_Matches.json	🗑
☐		drwxr-xr-x	arshgoyal	supergroup	0 B	Dec 08 13:24	0	0 B	Match_details.json	🗑
☐		drwxr-xr-x	arshgoyal	supergroup	0 B	Dec 08 13:24	0	0 B	Player_Profile.json	🗑
☐		drwxr-xr-x	arshgoyal	supergroup	0 B	Dec 08 13:24	0	0 B	Player_Rating.json	🗑
☐		drwxr-xr-x	arshgoyal	supergroup	0 B	Dec 08 13:19	0	0 B	csv	🗑
☐		drwxr-xr-x	arshgoyal	supergroup	0 B	Dec 08 13:21	0	0 B	json	🗑

Showing 1 to 7 of 7 entries   Previous 1 Next

Hadoop, 2019.

HADOOP FILE SYSTEM

PROBLEMS

- Setting up Streaming Spark
- Writing computations for streaming data in pyspark and using its functions
- Calculating player chemistry
- Regression for player ratings

CONCLUSION

We learnt the importance of writing good code using efficient algorithms for fast processing and less memory consumption. Also, we learnt the impact of using big data analytics for real world scenarios. This project has given us an opportunity to work with practical data and gain meaningful insights on the premier league.

EVALUATIONS:

SNo	Name	SRN	Contribution (Individual)
1	ANAND VARDHAN	PES1201800133	25%
2	ARSH GOYAL	PES1201800254	25%
3	ARPIT KUMAR	PES1201800406	25%
4	SUJITH K	PES1201802029	25%

(LEAVE THIS FOR THE FACULTY)

Date	Evaluator	Comments	Score

CHECKLIST:

SNo	Item	Status
1.	Source code documented	
2.	Source code uploaded to GitHub – (access link for the same, to be added in status)	
3.	Instructions for building and running the code. Your code must be usable out of the box.	