

Software Development Sensei

Episode 1: "Fantasy Tennis"



Making software development accessible for others

Fantasy Tennis

- A viewer for ATP tennis brackets (github.com/nathanesau/FantasyTennis)
- Allows user to make predictions and view future matchups
- Allows user to save predictions for later use
- Allows user to download bracket data from ATP website

Fantasy Tennis (sydney_pred)

File Edit Predictions

Round 1	Round 2	Round 3	Round 4
<div>Stefanos Tsitsipas (1)</div> <div>bye</div>	<div>Stefanos Tsitsipas (1)</div> <div>Matthew Ebden</div>		
<div>Matthew Ebden</div> <div>Guido Andreozzi (LL)</div>		<div>Stefanos Tsitsipas (1)</div> <div>Andreas Seppi (8)</div>	
<div>Martin Klizan</div> <div>Alexei Popyrin (WC)</div>	<div>Alexei Popyrin (WC)</div> <div>Andreas Seppi (8)</div>		
<div>Jeremy Chardy</div> <div>Andreas Seppi (8)</div>			<div>Andreas Seppi (8)</div> <div>Diego Schwartzman</div>
<div>Diego Schwartzman (3)</div> <div>bye</div>			

Technology Stack

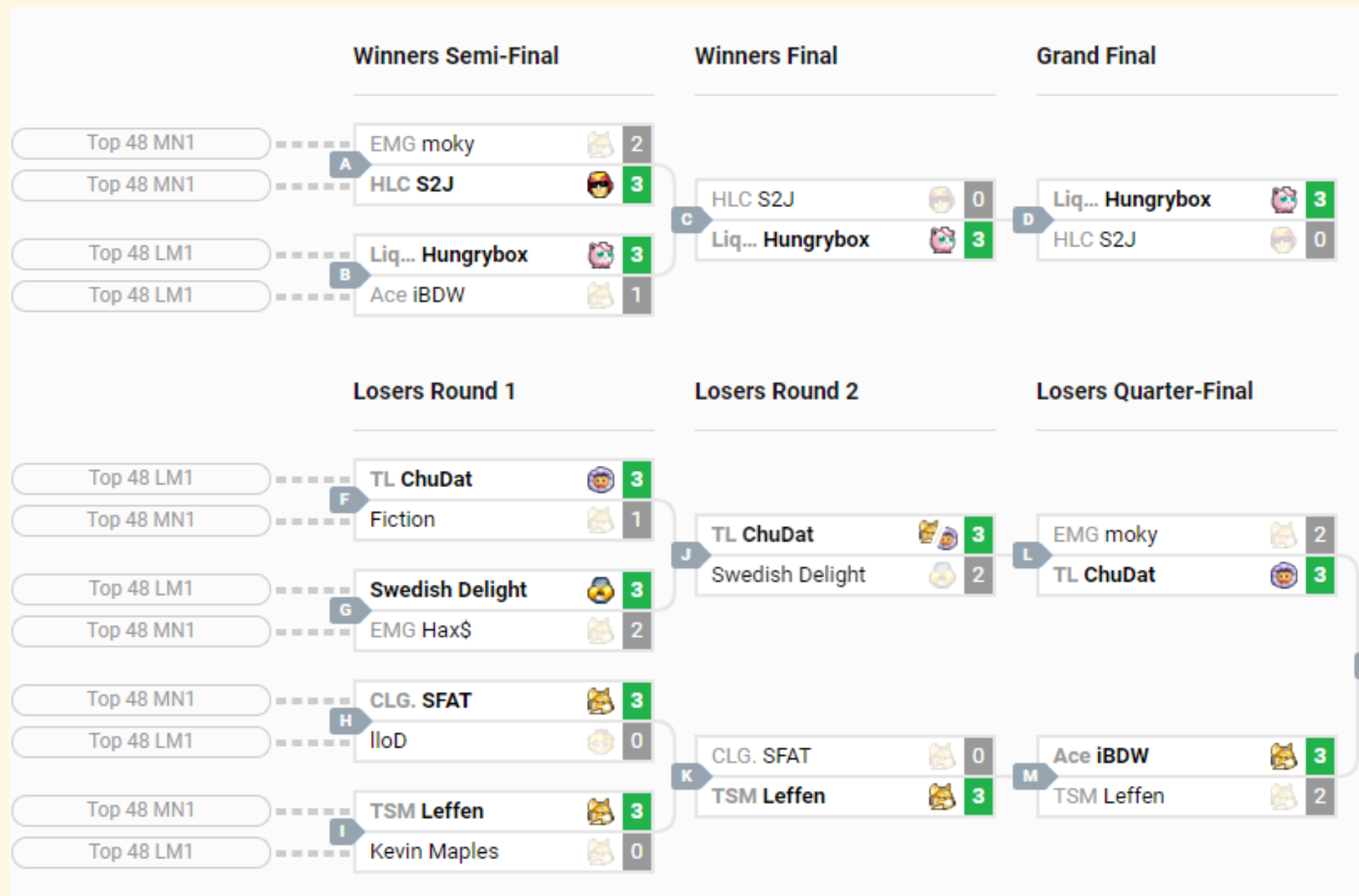
- Programming language: Python
- GUI framework: PyQt5
- IDE: Visual Studio Code

Specification

- Download HTML bracket
- Convert HTML bracket to Sqlite3
- Load Sqlite3 bracket
- Click on player name to make prediction
- Click on round to hide/ show round
- Save predictions
- Load predictions

Inspiration

- Competitive smash double elimination brackets
- Wanted to see who would play who in future rounds
- For large brackets, it is difficult to figure this out



Implementation

Discuss how application was created:

1. Web scraping with BeautifulSoup
2. Database code
3. Widget classes
4. Predictions logic

Web scraping

Simplified HTML code for US open bracket.

```
<div class="scores-draw-entry-box">
  <table class="scores-draw-entry-box-table">
    <tbody>
      <tr>
        <td>1</td> <!--playerID-->
        <td><span>(1)</span></td> <!--seed-->
        <td><a href="/en/players/novak-djokovic/d643/overview"></td>
      </tr>
    </tbody>
  </table>
</div>
```

Simplified snippet to parse the HTML tags (`html_to_db` function):

```
# output: seed, country, name

for box in soup.find_all('div', {'class': 'scores-draw-entry-box'}):
    table_tags = box.find_all('table')
    if len(table_tags): # round 1
        tr_tags = box.find_all('tr')
        for tr_tag in tr_tags:
            span_tags = tr_tag.find_all('span')
            seed = '' if not len(span_tags) else span_tags[0]
            a_tags = tr_tag.find_all('a')
            name = 'bye' if not len(a_tags) else a_tags[0]['data-ga-label']
            img_tags = tr_tag.find_all('img')
            country = '' if not len(img_tags) else img_tags[0]['src']
    else: # round 2, ...
        a_tags = box.find_all('a'):
        name = 'unknown' if not len(a_tags) else a_tags[0]['data-ga-label']
```

Comments on webscraping:

- Possibility of webscraping code being broken if website to scrape from is changed (i.e. tags are changed).
- I am maintaining an archive of the data [FantasyTennisData](#) should this happen (at least past tournaments will be available)

Database

- Draw table
 - Player matchups (top of bracket to bottom)
 - Round, Player1, Player2
- Player table
 - Player information (name is common to draw table and player table)
 - Player, Seed, Country

Draw table

#	id	Round	Player1	Player2
1	1	1	Stefanos Tsitsipas	bye
2	2	1	Matthew Ebden	Guido Andreozzi

Player table

#	id	Player	Seed	Country
1	1	Stefanos Tsitsipas	1	/en/~ /media/images/flags/gre.svg
2	2	bye	0	
3	3	Matthew Ebden	0	/en/~ /media/images/flags/aus.svg
4	4	Guido Andreozzi	LL	/en/~ /media/images/flags/arg.svg

Simplified database code snippet (TennisDatabase class):

```
def createTableDraw(self):
    q = QSqlQuery("CREATE TABLE DRAW (id INTEGER PRIMARY KEY, Round INTEGER, " +
                  "Player1 TEXT, Player2 TEXT)")
    q.isActive() # qWarning if failed

def populateTableDraw(self, drawRowList):
    q = QSqlQuery()
    q.prepare("INSERT INTO Draw(Round, Player1, Player2) VALUES(?,?,?)")
    QSqlDatabase.database().transaction()
    for r in drawRowList:
        q.bindValue(0, r[0]), q.bindValue(1, r[1]), q.bindValue(2, r[2])
        q.exec() # qWarning if failed
    QSqlDatabase.commit()

def loadTableDraw(self, drawRowList):
    q = QSqlQuery()
    q.exec("SELECT Round, Player1, Player2 FROM Draw") # qWarning if failed
    while q.next():
        roundNum, player1, player2 = q.value(0), q.value(1), q.value(2)
        drawRowList.append([roundNum, player1, player2])
```

Interface

- Develop interface intuition, i.e. when looking at a software program be able to recognize what widgets are used, what layouts are used, etc.
- For FantasyTennis, `MainWindow` contains a `QScrollArea`
 - The `QScrollArea` uses a central `Bracket` widget
 - The `Bracket` widget is a `QHBoxLayout` of `RoundBracket` widgets
 - Each `RoundBracket` is a `QVBoxLayout` of `BracketNode` widgets
 - Each `BracketNode` is a `GroupBox` with a `QVBoxLayout` of `PlayerNode` widgets
 - Each `PlayerNode` is a `QPushButton` (contains the data)

Fantasy Tennis (sydney_pred)

File Edit Predictions

RoundBracket

BracketNode

ScrollArea (Bracket)

Round 1	Round 2	Round 3	Round 4
Stefanos Tsitsipas (1) bye	Stefanos Tsitsipas (1) Matthew Ebdn	Stefanos Tsitsipas (1) Andreas Seppi (8)	Andreas Seppi Diego Schwartzma
Matthew Ebdn Guido Andreozzi (LL)			
Martin Klizan Alexei Popyrin (WC)	Alexei Popyrin (WC) Andreas Seppi (8)		
Jeremy Chardy Andreas Seppi (8)			
Diego Schwartzman (3) bye			

Simplified code from `Bracket` class:

```
class Bracket(QWidget):
    def __init__(self, roundBrackets):
        self.roundBrackets = roundBrackets # used to access data later
        self.mainLayout = QHBoxLayout()
        self.mainLayout.setSpacing(0)
        for roundNum in range(0, len(self.roundBrackets, 1), 1):
            self.mainLayout.addWidget(self.roundBrackets[roundNum])
        self.mainLayout.setSizeConstraint(QLayout.SetMinimumSize)
        self.setLayout(self.mainLayout)
```

Note:

- Using size constraints like this ensures all player names fit in the widgets
- Using layouts is recommended, since they automatically scale

Loading Bracket

- Provided that we have the database with the information shown before, we want to be able to view the database information in a user-friendly format
- Code to create the interface objects from the database is shown in next few slides

Simplified code snippet to load a bracket:

```
def getNodes(tennisData):
    nodes = {}, sdict = {}, cdict = {}
    for row in tennisData.playerRowList: # parse playerRowList
        player, seed, country = row[0], row[1], row[2]
        sdict[player] = seed, cdict[player] = country
    round1Rows = []
    for row in tennisData.drawRowList: # parse drawRowList
        (round1Rows.append(row) if row[0] is 1 else None)
    drawSize = len(round1Rows)
    numRounds = int(math.log(drawSize)/math.log(2)) + 1
    for row in tennisData.drawRowList:
        rn = row[0] # 1, 2, ...
        p = [row[1], row[2]]
        if rn <= numRounds:
            s = ['0' if not e in sdict else sdict[e] for e in p]
            c = ['' if not e in cdict else cdict[e] for e in p]
            d = [PlayerNodeData(p[i], s[i], c[i]) for i in range(2)]
            nd = BracketNodeData(d[0], d[1])
            nodes[rn] = [] if not rn in nodes else nodes[rn] + [BracketNode(nd, rn)]
    return nodes
```

Simplified code snippet to load a bracket (continued):

```
class MainWindow:
    def showData(self, tennisData):
        nodes = getNodes(tennisData) # previous slide

        roundBrackets = []
        for key in nodes.keys():
            roundBrackets.append(RoundBracket(nodes[key], key))

        self.bracket = Bracket(roundBrackets)
        self.scrollArea.setWidget(self.bracket)
```

Predictions

- When `PlayerNode` clicked, call `MainWindow.update` function
- In `MainWindow.update` determine which `PlayerNode` objects are affected
- For each affected node, call `PlayerNode.update`

Simplified code from `PlayerNode` class:

```
class PlayerNode(QWidget):
    clicked = pyqtSignal()

    def __init__(self, data, parent=None):
        super().__init__(parent)
        self.button = QPushButton()
        self.button.clicked.connect(self.clicked.emit)
        self.mainLayout = QHBoxLayout()
        self.mainLayout.addWidget(self.button)
        self.setLayout(self.mainLayout)
        self.origData = data
        self.update(data) # self.data

    def update(self, data):
        self.button.setIcon(QIcon(":/country" + data.country))
        self.button.setText(data.name + "(" + str(data.seed) + ")")
        s = "background-color:lightblue" if data.name != self.origData.name else ""
        self.setStyleSheet(s)
        self.data = data
```

Simplified code from BracketNode class:

```
class BracketNode(QWidget):
    def __init__(self, data, roundNum): # mainWindow reference not shown
        self.roundNum = roundNum
        self.p1Node = PlayerNode(data.playerOneNodeData)
        self.p1Node.clicked.connect(self.onNode1Clicked)
        self.p2Node = PlayerNode(data.playerTwoNodeData)
        self.p2Node.clicked.connect(self.onNode2Clicked)
        self.groupBoxLayout = QVBoxLayout()
        self.groupBoxLayout.addWidget(self.p1Node)
        self.groupBoxLayout.addWidget(self.p2Node)
        self.groupBox = QGroupBox()
        self.groupBox.setLayout(self.groupBoxLayout)
        self.mainLayout = QVBoxLayout()
        self.mainLayout.addWidget(self.groupBox)
        self.setLayout(self.mainLayout)

    def onNode1Clicked(self):
        self.mainWindow.updateBracket(self.p1Node.data, self.p2Node.data, self.roundNum)

    def onNode2Clicked(self):
        self.mainWindow.updateBracket(self.p2Node.data, self.p1Node.data, self.roundNum)
```

Simplified code from `MainWindow` class:

```
class MainWindow(QMainWindow):
    def getIndexDict(self, winner, loser, currRN): # indices affected each round
        indexDict = {}
        cbracket = self.bracket.roundBrackets[currRN-1] # 0-indexed
        for i in range(len(cbracket.bracketNodes)): # bracketNodes for round
            d1, d2 = BracketNodeData(winner, loser), BracketNodeData(loser, winner)
            if cbracket.bracketNodes[i].data is d1 or cbracket.bracketNodes[i].data is d2:
                indexDict[currRN] = [i+1]
                break
        for rn in range(currRN+1, len(self.bracket.roundBrackets)+1, 1)
            x = indexDict[rn-1]
            y = x + 1 if x % 2 else x
            indexDict[rn] = int(y/2) # click affects all future rounds
        return indexDict
```


Simplified code from `MainWindow` class (continued):

```
class MainWindow(QMainWindow):
    def updateBracket(self, winner, loser, currRN):
        indexDict = getIndexDict(winner, loser, currRN)
        for rn in range(currRN+1, len(self.bracket.roundBrackets)+1, 1):
            prev_index, index = indexDict[rn-1], indexDict[rn]
            top = prev_index % 2 # true if winner is at top of bracket node
            roundBracket = self.bracket.roundBrackets[rn-1]
            bracketNode = roundBracket
            playerNode = bracketNode.p1Node if top else bracketNode.p2Node
            pname, wname, lname = playerNode.data.name, winner.name, loser.name
            if pname != wname:
                if pname is lname or (pname is "unknown" and rn is currRN + 1):
                    # update bracket node info
                    playerNode.update(winner)

        self.bracket.repaint()
```

Closing implementation remarks

- Predictions are saved same way as `Draw` (three columns, `Round`, `Player1` and `Player2`) but to a different table.
- The program allows the user to specify directory for `html_data`, `data` and `predictions` (preferences). You can use `QSettings` for this sort of thing.
- Clicking on `Round 1`, `Round 2`, etc. buttons hides the `RoundBracket` (each time the button is pressed, the `Bracket` must be re-created (more complexity, not shown))
- This project is about 1000 lines of python code. I have split the code into roughly 10 python files (one file per class roughly).

Future improvements to this project

- The title of each `BracketNode` could contain information about the match (requires more HTML parsing).
- Double elimination brackets could be implemented for Smash style bracket (the reason I didn't do this yet, is because `Smash.gg` website is difficult to parse data from).