Sleep Analysis

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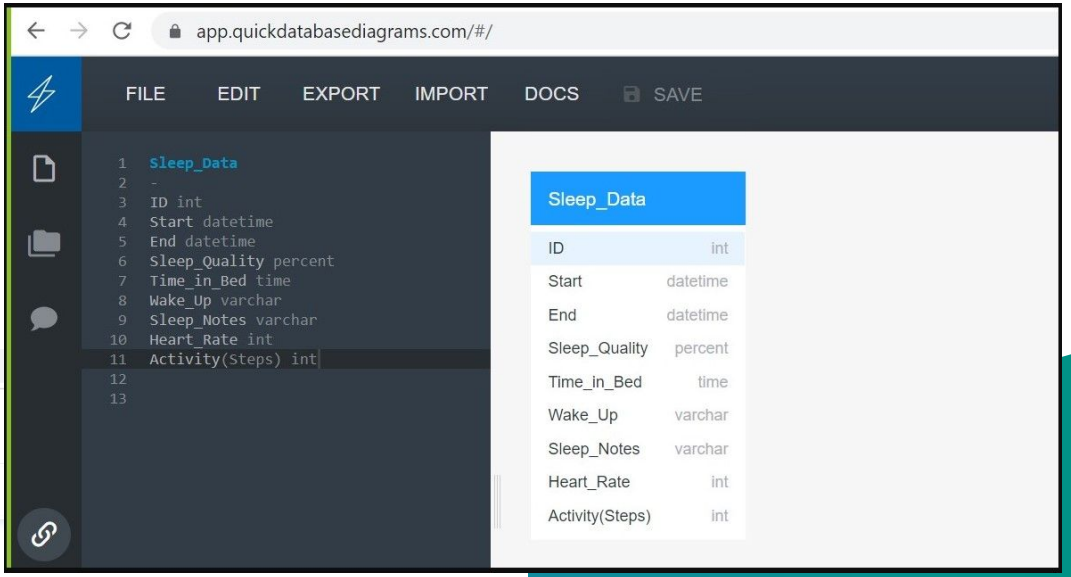
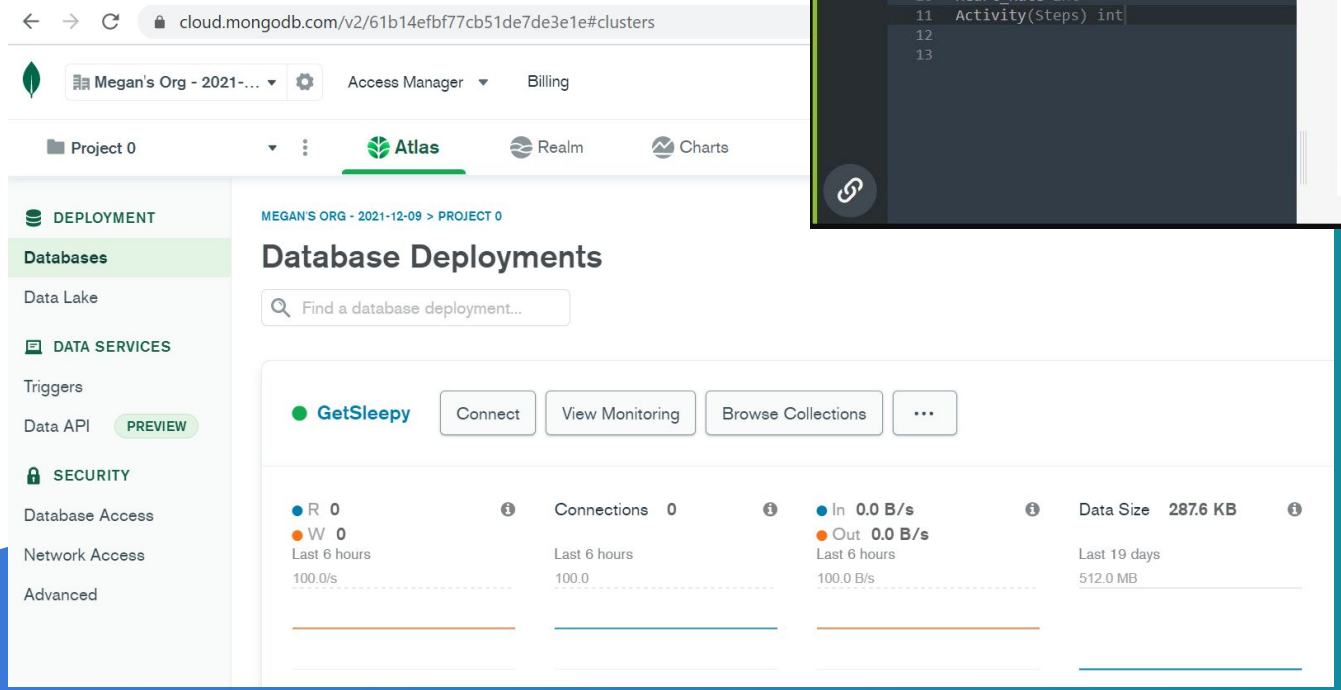
Overview

Questions to answer with the data

- Which behaviors contribute to quality sleep?
- How does one quantify “good sleep”?
- What will my sleep quality be?
- How well rested will I be?

Database





- Free
- Simple
- High Speed
- Flexible

Data discovery and selection

Original Kaggle Data Set - Sleep Cycle iOS App

Starting Data

Start	End	Sleep quality	Time in bed	Wake up	Sleep Notes	Heart rate	Activity (steps)
12/29/2014 22:57	12/30/2014 7:30	1	8:32:00 AM	:)		59	0
12/30/2014 21:17	12/30/2014 21:33	0.03	12:16:00 AM	:|	Stressful day	72	0
12/30/2014 22:42	12/31/2014 7:13	0.98	8:30:00 AM	:|		57	0
12/31/2014 22:31	1/1/2015 6:03	0.65	7:32:00 AM				0
1/1/2015 22:12	1/2/2015 4:56	0.72	6:44:00 AM	:)	Drank coffee:Drank tea	68	0
1/3/2015 0:34	1/3/2015 7:47	0.83	7:12:00 AM	:)	Drank coffee:Drank tea	60	0
1/4/2015 0:23	1/4/2015 7:37	0.78	7:14:00 AM		Drank tea		0
1/4/2015 21:34	1/5/2015 4:53	0.78	7:18:00 AM	:)	Ate late:Drank coffee	57	0
1/5/2015 21:32	1/6/2015 5:00	0.69	7:27:00 AM	:)	Drank coffee:Drank tea:Worked out	56	0
1/6/2015 21:24	1/7/2015 5:00	0.74	7:35:00 AM	:|	Drank tea:Worked out	64	0
1/7/2015 20:59	1/8/2015 6:19	0.81	9:19:00 AM	:)	Drank coffee:Drank tea:Stressful day	62	0
1/8/2015 22:58	1/9/2015 6:14	0.88	7:16:00 AM	:)	Drank coffee:Drank tea	58	0
1/9/2015 22:27	1/10/2015 7:29	0.77	9:01:00 AM	:|	Drank coffee:Drank tea	65	0
1/10/2015 22:38	1/11/2015 7:28	0.89	8:50:00 AM	:|	Drank coffee:Drank tea	65	0
1/11/2015 22:12	1/12/2015 6:20	0.78	8:08:00 AM	:)	Drank tea	53	0
1/12/2015 21:01	1/13/2015 6:13	1	9:11:00 AM	:)	Drank tea:Worked out	65	0
1/13/2015 22:14	1/14/2015 6:20	1	8:06:00 AM	:)	Drank coffee:Drank tea	55	0
1/14/2015 21:48	1/15/2015 5:02	0.88	7:13:00 AM	:)	Drank coffee:Drank tea:Worked out	60	0
1/15/2015 21:32	1/16/2015 4:54	0.87	7:22:00 AM	:)	Drank tea	60	0
1/17/2015 2:11	1/17/2015 9:03	0.83	6:51:00 AM	:)	Drank coffee:Drank tea	94	0
1/17/2015 23:55	1/18/2015 7:47	0.93	7:51:00 AM	:)	Drank coffee:Drank tea	57	0
1/18/2015 21:51	1/19/2015 5:04	0.58	7:12:00 AM	:)	Drank coffee	67	0
1/19/2015 5:06	1/19/2015 6:20	0.16	1:13:00 AM	:)		58	0
1/19/2015 21:45	1/20/2015 5:45	0.75	8:00:00 AM	:|	Drank coffee:Drank tea:Worked out	54	0
1/20/2015 21:42	1/21/2015 5:45	0.8	8:02:00 AM	:|	Drank coffee:Drank tea:Worked out	60	0

Modified Data

Start	End	Sleep qualit	Time in bed	Wake up	Heart rate	Activity (ste	Stressful da	Drank coffe	Drank tea	T	Ate late	Tot	Worked out	Total
12/29/2014 22:57	12/30/2014 7:30	100%	8:32	:)	59	0	0	0	0		0	0	0	
12/30/2014 21:17	12/30/2014 21:33	3%	0:16	:|	72	0	1	0	0		0	0	0	
12/30/2014 22:42	12/31/2014 7:13	98%	8:30	:|	57	0	0	0	0		0	0	0	
12/31/2014 22:31	1/1/2015 6:03	65%	7:32			0	0	0	0		0	0	0	
1/1/2015 22:12	1/2/2015 4:56	72%	6:44	:)	68	0	0	0	1		1	0	0	
1/3/2015 0:34	1/3/2015 7:47	83%	7:12	:)	60	0	0	0	1		1	0	0	
1/4/2015 0:23	1/4/2015 7:37	78%	7:14			0	0	0	0		1	0	0	
1/4/2015 21:34	1/5/2015 4:53	78%	7:18	:)	57	0	0	0	1		0	1	0	
1/5/2015 21:32	1/6/2015 5:00	69%	7:27	:)	56	0	0	0	1		1	0	1	
1/6/2015 21:24	1/7/2015 5:00	74%	7:35	:|	64	0	0	0	0		1	0	1	
1/7/2015 20:59	1/8/2015 6:19	81%	9:19	:)	62	0	1	1	1		1	0	0	
1/8/2015 22:58	1/9/2015 6:14	88%	7:16	:)	58	0	0	0	1		1	0	0	
1/9/2015 22:27	1/10/2015 7:29	77%	9:01	:|	65	0	0	0	1		1	0	0	
1/10/2015 22:38	1/11/2015 7:28	89%	8:50	:|	65	0	0	0	1		1	0	0	
1/11/2015 22:12	1/12/2015 6:20	78%	8:08	:)	53	0	0	0	0		1	0	0	
1/12/2015 21:01	1/13/2015 6:13	100%	9:11	:)	65	0	0	0	0		1	0	1	
1/13/2015 22:14	1/14/2015 6:20	100%	8:06	:)	55	0	0	0	1		1	0	0	
1/14/2015 21:48	1/15/2015 5:02	88%	7:13	:)	60	0	0	0	1		1	0	1	
1/15/2015 21:32	1/16/2015 4:54	87%	7:22	:)	60	0	0	0	1		0	0	0	
1/17/2015 2:11	1/17/2015 9:03	83%	6:51	:)	94	0	0	1	1		1	0	0	
1/17/2015 23:55	1/18/2015 7:47	93%	7:51	:)	57	0	0	0	1		1	0	0	
1/18/2015 21:51	1/19/2015 5:04	58%	7:12	:)	67	0	0	0	1		0	0	0	
1/19/2015 5:06	1/19/2015 6:20	16%	1:13	:)	58	0	0	0	0		0	0	0	
1/19/2015 21:45	1/20/2015 5:45	75%	8:00	:|	54	0	0	0	1		1	0	1	
1/20/2015 21:42	1/21/2015 5:45	80%	8:02	:|	60	0	0	0	1		1	0	1	

Data Cleaning

	Start	End	Sleep quality	Time in bed	Wake up	Heart rate	Activity (steps)	Stressful day Total	Drank coffee Total	Drank tea Total	Ate late Total	Worked out Total
0	12/29/2014 22:57	12/30/2014 7:30	100%	8:32	:)	59	0	0	0	0	0	0
1	12/30/2014 21:17	12/30/2014 21:33	3%	0:16	:|	72	0	1	0	0	0	0
2	12/30/2014 22:42	12/31/2014 7:13	98%	8:30	:|	57	0	0	0	0	0	0
3	12/31/2014 22:31	1/1/2015 6:03	65%	7:32			0	0	0	0	0	0
4	1/1/2015 22:12	1/2/2015 4:56	72%	6:44	:)	68	0	0	1	1	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...
882	2/12/2018 21:54	2/13/2018 7:02	91%	9:08			56	0	0	0	0	0
883	2/13/2018 23:49	2/14/2018 7:00	81%	7:11			64	0	0	0	0	0
884	2/14/2018 21:24	2/15/2018 6:20	71%	8:56			3316	0	0	0	0	0
885	2/15/2018 21:36	2/16/2018 6:50	80%	9:13			6555	0	0	0	0	0
886	2/16/2018 22:52	2/17/2018 7:48	91%	8:55			2291	0	0	0	0	0

887 rows × 13 columns

```
#Check data types to prepare for preporcessing
df.dtypes
```

```
Start                 object
End                   object
Sleep quality         object
Time in bed           object
Wake up               object
Heart rate            object
Activity (steps)      object
Stressful day Total   object
Drank coffee Total    object
Drank tea Total       object
Ate late Total        object
Worked out Total      object
                      object
dtype: object
```

Emoji Estimator

Start		User input, 24-hr time
End		User input, 24-hr time
Heart Rate		User input, if applicable (smart watch required)
Activity		User input, if applicable (step counter required)
Stressful Day	☐	User input, checkbox
Drank coffee	☐	User input, checkbox
drank tea	☐	User input, checkbox
ate late	☐	User input, checkbox
Worked out	☐	User input, checkbox
SUBMIT		User input, BUTTON
Sleep Quality		Computed based on Start/end time
Time in Bed		Computed based on Start/end time
Predicted mood!		EMOJI!

Pivot Direction

In [42]:
```
#DataFrame with the former target "Wake up"

```

Out[42]:

	Sleep quality	Time in bed	Wake up	Heart rate	Activity (steps)	Stressful day Total	Drank coffee Total	Drank tea Total	Ate late Total	Worked out Total	Fell asleep
0	100	512	:)	59	0	0	0	0	0	0	2257
1	3	16	:|	72	0	1	0	0	0	0	2117
2	98	510	:|	57	0	0	0	0	0	0	2242
4	72	404	:)	68	0	0	1	1	0	0	2212
5	83	432	:)	60	0	0	1	1	0	0	34
...	...	...	...	...	...	...	...	...	...	...	...
229	93	493	:)	67	0	1	0	1	0	1	2157
231	80	482	:)	52	0	0	1	0	0	0	2207
235	72	480	:|	56	0	0	1	1	0	1	2219
240	79	513	:|	71	0	0	1	1	0	0	2353
241	85	504	:)	65	0	0	1	1	0	0	2349

In [18]:
```
# DateFrame for the new target "Sleep quality" after dropping "Wake up" and "Heart rate" columns

```

Out[18]:

	Sleep quality	Time in bed	Activity (steps)	Stressful day Total	Drank coffee Total	Drank tea Total	Ate late Total	Worked out Total	Fell asleep
0	65	452	0	0	0	0	0	0	2231
1	89	530	0	0	1	1	0	0	2238
2	100	512	0	0	0	0	0	0	2257
3	87	442	0	0	0	1	0	0	2132
4	93	483	0	1	1	1	0	0	13
...	...	...	...	...	...	...	...	...	...
882	80	513	5184	0	0	0	0	0	2135
883	81	505	2544	0	0	0	0	0	2130
884	90	481	4529	0	0	0	0	0	2222
885	79	503	107	0	0	0	0	0	2137
886	8	36	166	0	0	0	0	0	832

887 rows × 9 columns

Linear Regression Model

In [67]:
```
# Instantiate the LinearRegression Model
linear = LinearRegression()
linear
```

Out[67]: LinearRegression()

In [68]:
```
# Train the Model
linear.fit(X_train, y_train)
```

Out[68]: LinearRegression()

In [45]:
```
# Predict outcomes for test data set
y_pred = linear.predict(X_test)
pd.DataFrame({"Prediction": y_pred, "Actual": y_test})
```

Out[45]:

	Prediction	Actual
522	80.772393	79
314	79.054583	86
768	79.260579	73
320	71.616312	72
809	70.284922	74
...	...	...
35	76.282396	64
46	78.570687	80
255	77.138954	78
670	81.788098	96
744	82.677151	82

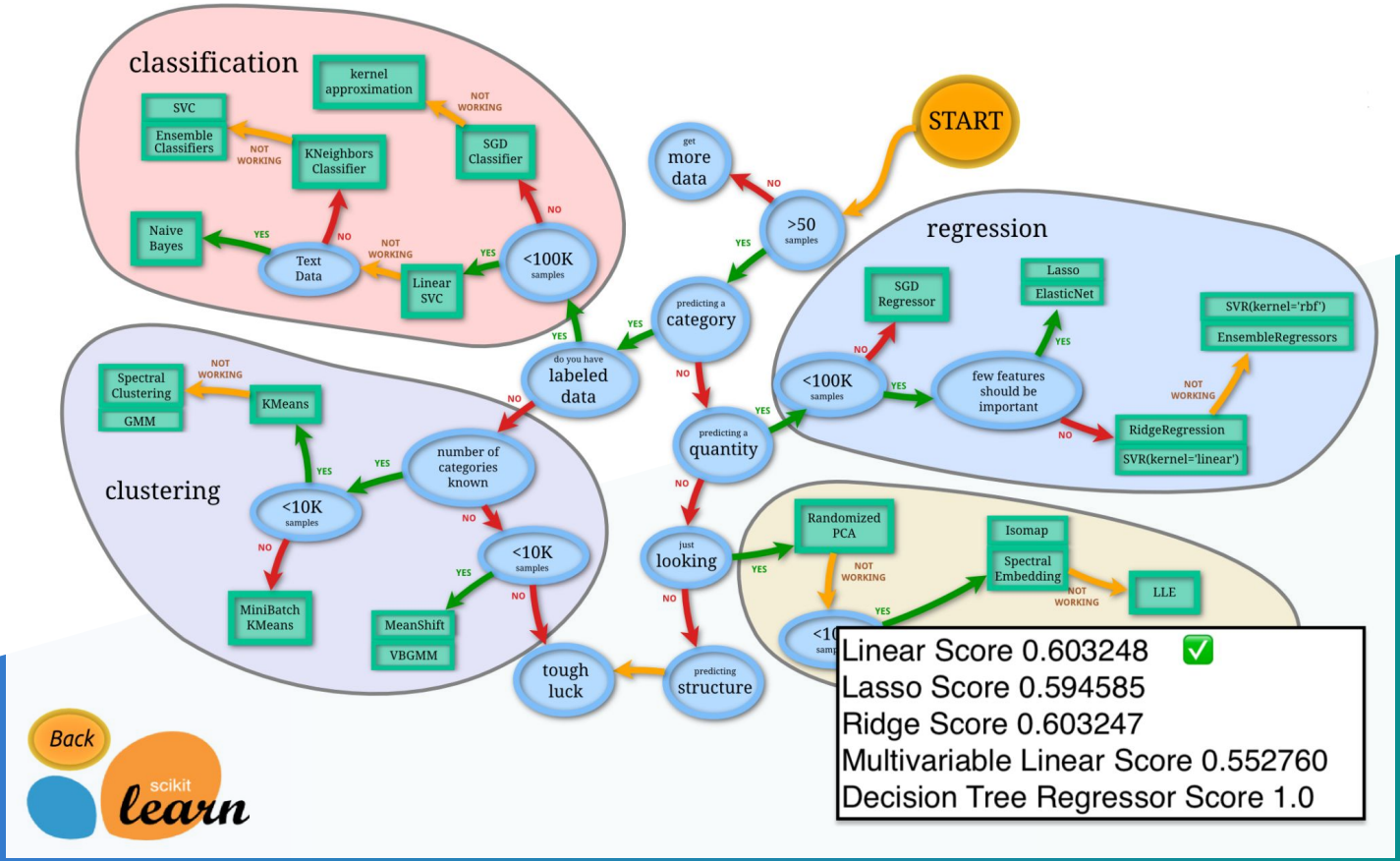
222 rows × 2 columns

In [46]:
```
# Score the Model
linear.score(X_train, y_train)

```

Out[46]: 0.603248893596652

Model Testing



Flask Assembly

app.py 2 ●

the_rest > app.py > ML

```python

from joblib import load
from flask import Flask, render_template, jsonify
import os

app = Flask(__name__)
model = load('./ML/linear.joblib')
@app.route("/")
def root():
    return render_template("index.html")

@app.route("/ML/<input1>/<input2>/<input3>/<input4>/<input5>/<input6>/<input7>/<input8>")
def ML(input1,input2,input3,input4,input5,input6,input7,input8):

    user_input = [input1,input2,input3,input4,input5,input6,input7,input8]
    user_input2 = list(map(int, user_input))

    print(user_input2)

    result = model.predict([user_input2])
    print(type(result))

    return jsonify(result[0])


if __name__ == "__main__":
    app.run(debug=True)
```

index.html ×

the_rest > templates > index.html > ...

```html
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <meta http-equiv="X-UA-Compatible" content="ie=edge">
  <title>Sleep Quiz</title>
  <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.min.css">
  <link rel="stylesheet" href="static/css/style.css">
</head>

<body>
    <div class="container">
        <div class="row">
          <div class="col-md-12 jumbotron text-center">
            <h1>What Was the Quality of My Sleep?</h1>
            <p>Use the interactive quiz below to find out!</p>
          </div>
        </div>
    <form>
        <table>
            <tr>
                <td><label for = 'timeInBed'>Time in Bed (min):</label></td>
                <td><input type = 'text' id = 'timeInBed'></td>
            </tr>
            <tr>
                <td><label for = 'fellAsleep'>Time fell asleep (military time)</label></td>
                <td><input type = 'text' id = 'fellAsleep'></td>
            </tr>
            <tr>
                <td><label for = 'activity'>Activity:</label></td>
                <td><input type = 'text' id = 'activity'></td>
            </tr>
            <tr>
```

Project Challenges

Final Product

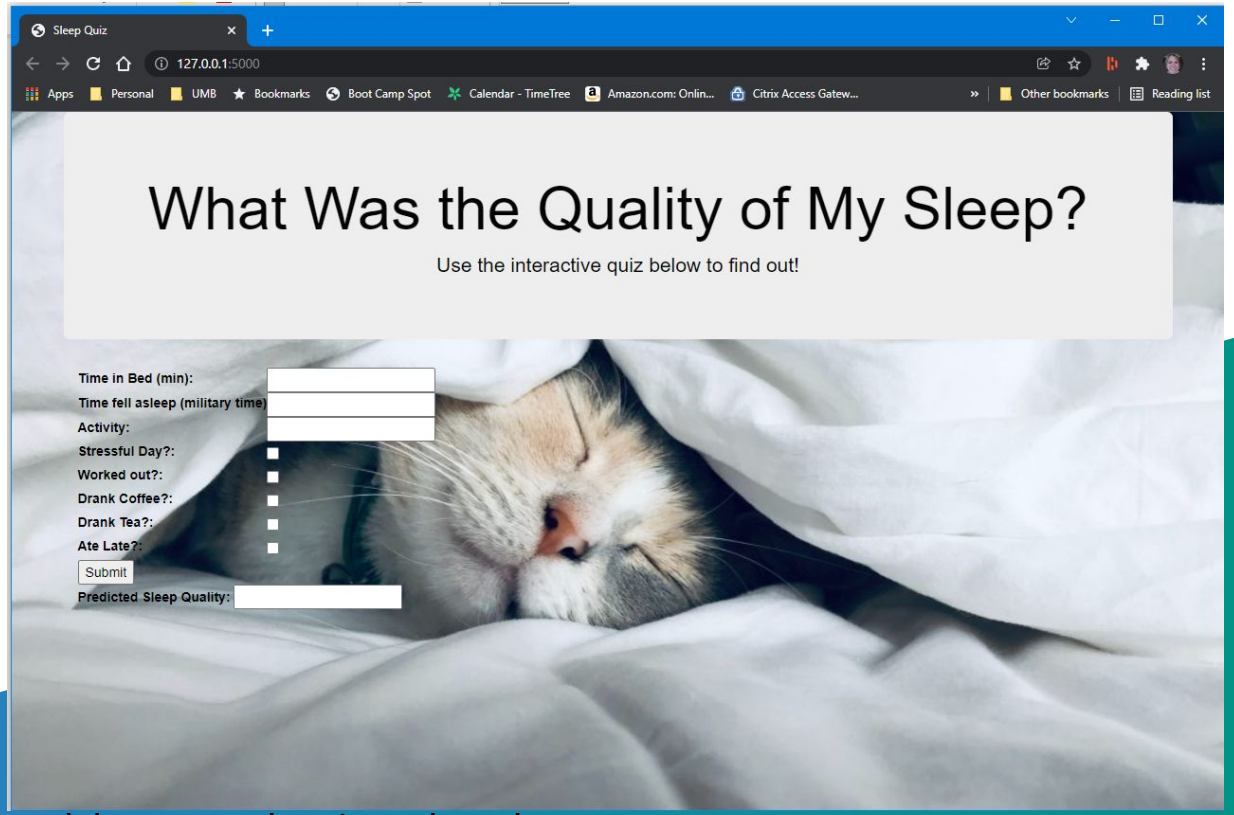
Finished Model

Web Page

Dashboard

Tableau Visualizations

- Wake Up
- Sleep Notes
- Activity
- Time in Bed
- Heart Rate



Improvement Ideas:

- Save user inputs and retrain model as more data is gathered.
- Format user inputs to adhere to needed numbers or trigger an error.
- Suggest ways to improve sleep quality
- Build marketing database of users for various sponsors.