FHIR PROJECT WEEK 6

SHUNYANG DONG

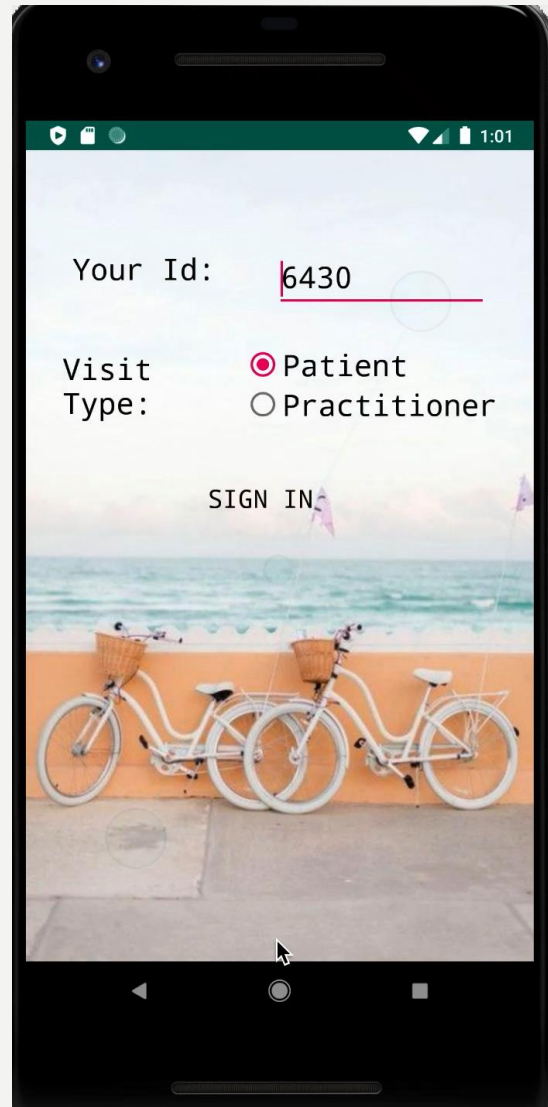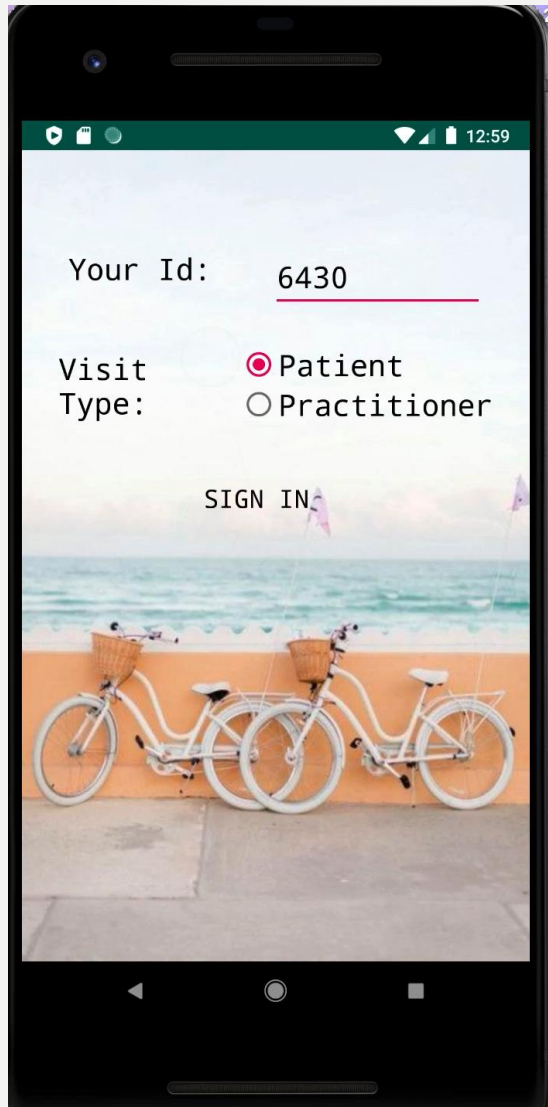# PART 1 – ANDROID APP

EXISTING MEDICAL HEALTH APP

1. webMD pain coach

- Symptom checker: enter your age, gender –> answer questions –> enter symptom –> possible condition;
- Medication reminder: Enter medication name, custom dosage, time
- Drug saving: Find lowest price

2. Appointik (Android app): make appointment with doctors

FIREBASE

https://fhirproject-3584e.firebaseio.com/
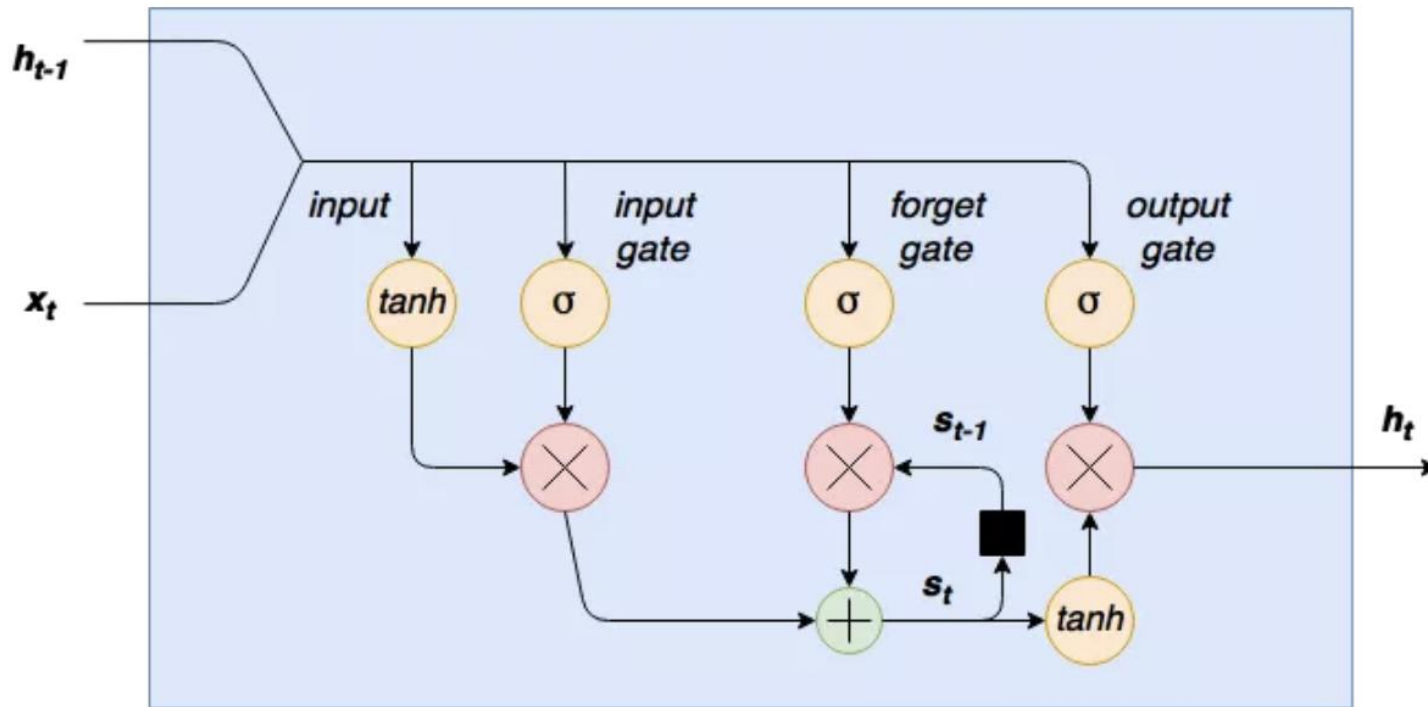
fhirproject-3584e
- messages
- users

NEXT STEP

- Add option menu/ fab/ navigate drawer ?

- Implement appointment function ?

- Implement editing profile functionality?

- View others' profile?

PART2 – DEEP LEARNING

RNN – LSTM MODEL

LSTM cell diagram

BODY WEIGHT PREDICTION

PATIENT/6430

	issued	bodyWeight
0	2009-11-21T19:50:54.401+00:00	110.362138
1	2010-11-27T19:50:54.401+00:00	108.772501
2	2011-12-03T19:50:54.401+00:00	106.917559
3	2012-12-08T19:50:54.401+00:00	105.906451
4	2013-12-14T19:50:54.401+00:00	104.018279
5	2014-12-20T19:50:54.401+00:00	102.127753
6	2015-12-26T19:50:54.401+00:00	98.433750
7	2016-12-31T19:50:54.401+00:00	97.316682
8	2018-01-06T19:50:54.401+00:00	96.275791
9	2019-01-12T19:50:54.401+00:00	94.523403

```
In [127]: predicted_raw
Out[127]: [95.82804152394353]

In [128]: y_test_raw
Out[128]: array([96.27579132])
```

PATIENT/144358

	issued	bodyWeight
0	2001-08-25T23:16:19.852+00:00	2.973666
1	2001-09-29T23:16:19.852+00:00	2.973666
2	2001-12-01T23:16:19.852+00:00	4.240131
3	2002-02-02T23:16:19.852+00:00	5.795395
4	2002-05-04T23:16:19.852+00:00	7.014608
5	2002-08-03T23:16:19.852+00:00	7.972624
6	2002-11-02T23:16:19.852+00:00	8.731682
7	2002-12-28T23:16:19.852+00:00	8.949611
8	2003-06-28T23:16:19.852+00:00	9.998086
9	2003-12-27T23:16:19.852+00:00	10.783533

```
In [90]: predicted_raw
Out[90]: [8.480239323880640

In [91]: y_test_raw
Out[91]: array([9.99808558
```

```
next_timestamp = model.predict(last)
next_timestamp = np.reshape(prediction, (prediction.size,))
next_timestamp_raw = (next_timestamp[0] + 1) * last_raw[0][0]
```

The next time stamp forecasting is: 14.029178282686875

```
print('The next time stamp forecasting is: {}'.format(next_timestamp_raw))
```

The next time stamp forecasting is: 92.58271778402573

TRAIN MODEL

```python
model = Sequential()
model.add(LSTM(input_shape=(lstm_layer[1], lstm_layer[0]), output_dim=lstm_layer[1], return_sequences=True))
model.add(Dropout(0.2))
model.add(LSTM(lstm_layer[2], return_sequences=False))
model.add(Dropout(0.2))
model.add(Dense(output_dim=lstm_layer[3]))
model.add(Activation("tanh"))
model.compile(loss="mean_squared_error", optimizer="rmsprop")
```

```
model.fit(x_train,y_train,batch_size=2,epochs=100,validation_split=0.1)
1/1 [==============================] - 0s 9ms/step - loss: 6.7605e-06 - val_loss: 0.0422
Epoch 92/100
1/1 [==============================] - 0s 8ms/step - loss: 8.7159e-06 - val_loss: 0.0444
Epoch 93/100
1/1 [==============================] - 0s 8ms/step - loss: 1.2532e-05 - val_loss: 0.0419
Epoch 94/100
1/1 [==============================] - 0s 8ms/step - loss: 6.8970e-05 - val_loss: 0.0478
Epoch 95/100
1/1 [==============================] - 0s 8ms/step - loss: 5.6658e-05 - val_loss: 0.0427
Epoch 96/100
```

CHOLESTEROL PREDICTION

	issued	cholestrol
0	2009-05-25T19:50:54.401+00:00	181.843353
1	2010-05-25T19:50:54.401+00:00	164.570185
2	2011-05-25T19:50:54.401+00:00	152.820398
3	2011-12-03T19:50:54.401+00:00	176.606214
4	2012-05-24T19:50:54.401+00:00	174.401612
5	2013-05-24T19:50:54.401+00:00	159.350694
6	2014-05-24T19:50:54.401+00:00	152.017338
7	2014-12-20T19:50:54.401+00:00	172.525137
8	2015-05-24T19:50:54.401+00:00	187.098595
9	2016-05-23T19:50:54.401+00:00	158.054380

```
predicted_raw

[159.40737690260048]


y_test_raw

array([187.09859453])
```

```
The next time stamp forecasting is: 181.91880046097629
```

EXPORT LSTM MODEL AS TFLITE

Why doesn't my model convert?

Since the number of TensorFlow Lite operations is smaller than TensorFlow's, some inference models may not be able to convert. For unimplemented operations, take a look at the question on missing operators. Unsupported operators include embeddings and LSTM/RNNs. For models with LSTM/RNNs, you can also try the experimental API OpHint to convert. Models with control flow ops (Switch, Merge, etc) are not convertible at the moment, but we are working on adding support for control flow in Tensorflow Lite, please see GitHub issues.

For conversion issues not related to missing operations or control flow ops, search our GitHub issues or file a new one.

```python
model.save('rnn.h5')
new_model= tf.keras.models.load_model(filepath="/Users/shunyang/FHIR_coding/week5/rnn.h5")
converter = tf.lite.TFLiteConverter.from_keras_model(new_model)
tflite_model = converter.convert()
open("rnn_model.tflite", "wb").write(tflite_model)
```

```
                    week5 — shunyang@vpn-118-138-191-169 — .._coding/week5 — -zsh — 125×5
  File "/opt/miniconda3/envs/tensorflow/lib/python3.6/site-packages/tensorflow/python/framework/convert_to_constants.py", lin
e 166, in convert_variables_to_constants_v2
    raise ValueError("Cannot find the Placeholder op that is an input
ValueError: Cannot find the Placeholder op that is an input to the ReadVariableOp.
```

OPHINT

- https://github.com/tensorflow/tensorflow/blob/master/tensorflow/lite/experimental/examples/lstm/g3doc/README.md

- https://fossies.org/linux/tensorflow/tensorflow/lite/experimental/examples/lstm/g3doc/README.md

NEXT STEP

- Implementing RNN using ops api in order to convert model to tflite?

- Working on other deep learning model?

PRAT3 – CURRENT FHIR DATA

HOW TO USE MORE INFORMATION?

PATIENT 6430

- ENCOUNTER: 40 entries. Start from 1986.
- DIAGNOSTIC REPORT: 35 entries. Strat from 2009.
- OBSERVATION:384 entries. Start from 2009.

For each diagnostic report, have multiple observations(eg. Blood pressure).

For each encounter, contains information:

ENCOUNTER?PATIENT = 6430

- resource – class – code： 1. WELLNESS 2. ambulatory (has reason) 3. emergency

- type –text: encounter for check up/ Follow–up encounter/Emergency room admission (procedure) /encounter for symptom (has a reason)

- subject: patient/6430
- participant – individual – reference:practitioner/10
- seviceProvider: organisation/41

- period – start:"2011–12–03T19:50:54+00:00", "end":"2011–12–03T20:05:54+00:00"

- reason: hyperlipidemia / Sinusitis (disorder)

http://hapi–fhir.erc.monash.edu:8080/baseDstu3/Encounter?reason=55822004&patient=6430 ==> returns 33 entries �