**Motivation**

- According to CDC, >100 million adults in the US lived with diabetes or prediabetes, disease that limits life conditions of patients and put on risk their life is mismanaged.
- Diabetics patients use manual monitoring systems to use insulin self-injections and control the level of glucose in the blood (CGM).
- By accurately predicting the level of glucose in a systematic basis, patients could improve their life conditions and prevent health risks.

**Data**

- We used Diego’s personal CGM and insulin pump records from last 4 months between December `18 and March `19, totaling ~35K observations, including:
  1. Blood glucose levels (every 5 minutes)
  2. Insulin infusions, including the basal rate (not frequently adjusted) and “bolus”
  3. Carbohydrates eaten

**Features**

- The process of data collection and preparation include the following steps:
  1. Upload the insulin pump information to the t-connect diabetes management application. The application is provided by Tandern.
  2. From t-connect we download a csv file with raw data, including 3 data tables: one with the glucose level observations (every 5 minutes), other with the basal rates (every time it changes), and other with the insulin bolus and carbs (when bolus was applied)
  3. The 3 tables are consolidated in one, interpolating data if missing value, or blank otherwise. The basal rates, insulin bolus, and carbs are re-calculated to 5-minute slot.
  4. After the data processing, the data is scaled, randomized and split between train (72.25%), dev (12.75%) and test (15%) sets.

**Results**

- We compared a Recurrent Neural Network with 2 baseline models: naive and ARIMA.
- The architecture used in the RNN was:
  
<table>
<thead>
<tr>
<th>Method</th>
<th>Result (RMSE, mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naive</td>
<td>32.117</td>
</tr>
<tr>
<td>ARIMA</td>
<td>54.2</td>
</tr>
<tr>
<td>RNN</td>
<td>24.578</td>
</tr>
</tbody>
</table>

- The best model was the RNN. Below are some comparisons of the predicted vs. the actual values.

**Conclusion**

- In this project, we use a RNN to predict the blood glucose level of a diabetic person taking as input the previous blood glucose level, insulin infused and carbs eaten.
- The results of the RNN model are better than the baseline models (Naive and ARIMA), but not superior than those found in the literature.

**Future Work**

- Compare the use of several patients data to train a general model than can be customized as a second step to a particular patient.
- Incorporate physical activity indicators as inputs in the model using information from wearable devices, such as a Fitbit or Apple Watch.

**References**

- Anitha, P. V. ('06). Application of a radial basis function neural.