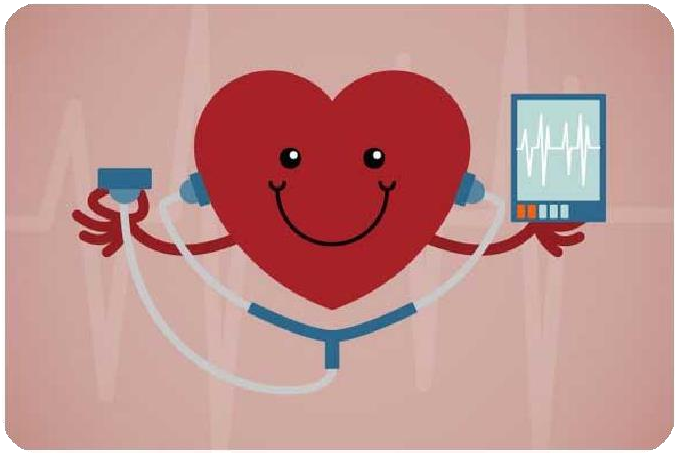
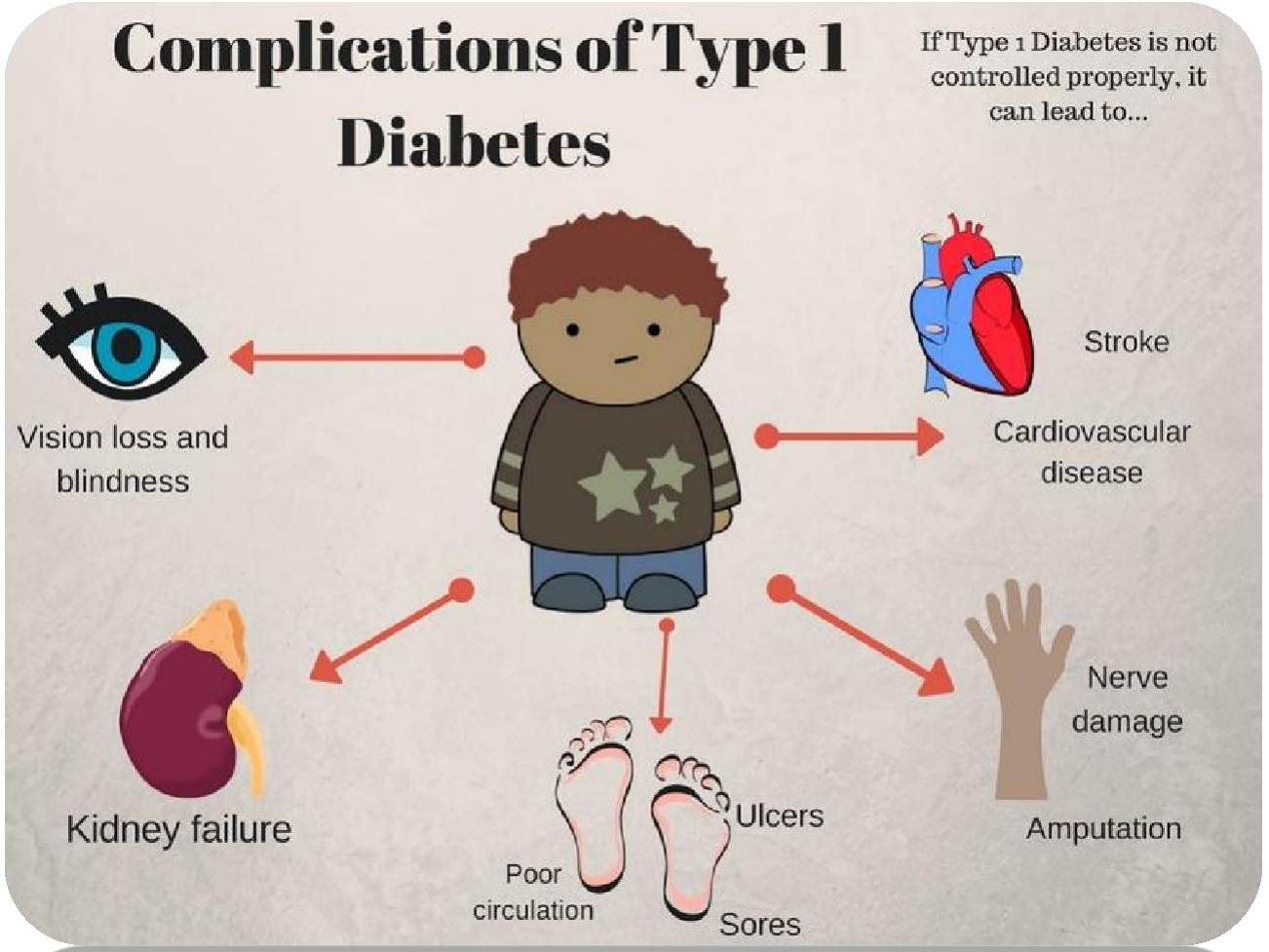
Deep neural network based hypoglycemia detection


Diabetes, Sleep & Cardiovascular Health




Complications of Type 1 Diabetes
If Type 1 Diabetes is not controlled properly, it can lead to...
Vision loss and blindness
Stroke
Cardiovascular disease
Kidney failure
Poor circulation
Ulcers
Sores
Nerve damage
Amputation

Low blood sugar levels

"Your body needs fuel to survive and run properly," said Dr. Simon Fisher, an associate professor of medicine, cell biology and physiology at Washington University in St. Louis. "During hypoglycemia, the body is low on energy. When hypoglycemia is more severe, the brain [which runs on sugar] can get confused and stop functioning. If the blood sugar gets low enough, hypoglycemia can be fatal.“

TUESDAY, April 22, 2014 (HealthDay News) -- Low blood sugar levels -- known as hypoglycemia -- in people with diabetes may cause potentially dangerous changes in heart rate, according to a small new study.

This study's findings may help explain why a large-scale study found that very tight control of blood sugar levels in people with type 2 diabetes led to higher-than-expected death rates. It may also help explain why some otherwise healthy people with type 1 diabetes die during their sleep -- sometimes called "dead-in-bed syndrome" -- without an apparent cause, researchers say.

Feedback from family

- As a family on of your biggest fear waking up in the middle of the night or first thing in the morning and either testing your family member and finding them dangerously low or possibly dead.

Past Solution:
Wearing a continuous glucose meter

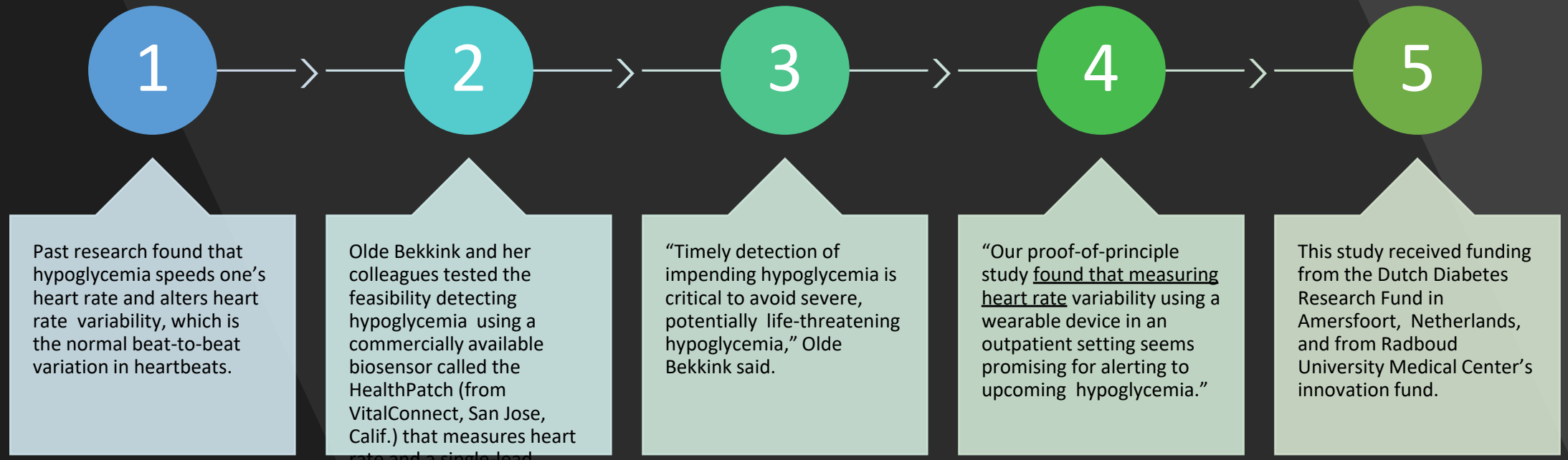
Although wearing a continuous glucose meter can help identify hypoglycemia, the glucose sensor, inserted under the skin, typically has a delay.

"This delay can compromise the accuracy of measuring low glucose values," said the study's principal investigator, Marleen Olde Bekkink, M.D., Ph.D., an endocrinology fellow at Radboud University Medical Center in Nijmegen, Netherlands.

"People with impaired awareness of hypoglycemia may need to wear an

additional monitor."

Low Blood Sugar Affect Heartbeat



Solution: Wearable heart rate monitor

- A wearable medical patch measuring the beat-to-beat variation in heart rate is a promising device for the early detection of hypoglycemia, or low blood sugar, in type 1 diabetes.

Introduction

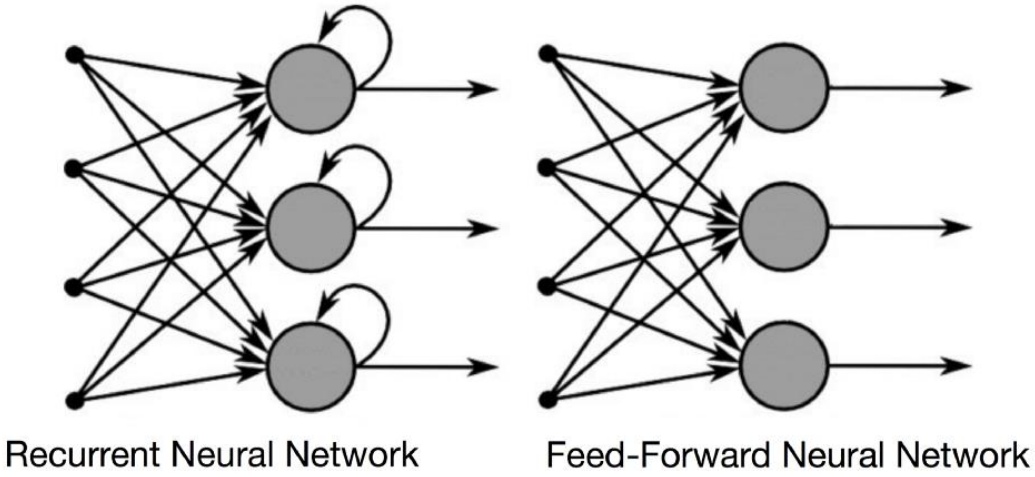
- A wearable Heart Rate Device measuring the beat-to-beat variation in heart rate is a promising device for the early detection of hypoglycemia, or low blood sugar, in type 1 diabetes. System sends immediate alerts to your smart device or receiver when your heartrate is trending too high or too low.The Arduino sensor detects the heartbeats through the pulse sensor. Do real-time analytics on the continuous streams of data coming from sensor after preprocessing in board Such as Aggregation, Categorize data in order to Reduce the amount of data transmitted to analytics servers and Reduce the amount of data to be stored . Data Pre-processed with raspberry pi and then submitted to the Machine Learning algorithm. ML algorithm does Classification of Heart Disease Using deep neural network and detect Heart Disease such as Atrial fibrillation(Atrial fibrillation (AF or A-fib) is an abnormal heart rhythm characterized by rapid and irregular beating) Finally all Data sent to Realtime Database by google data base

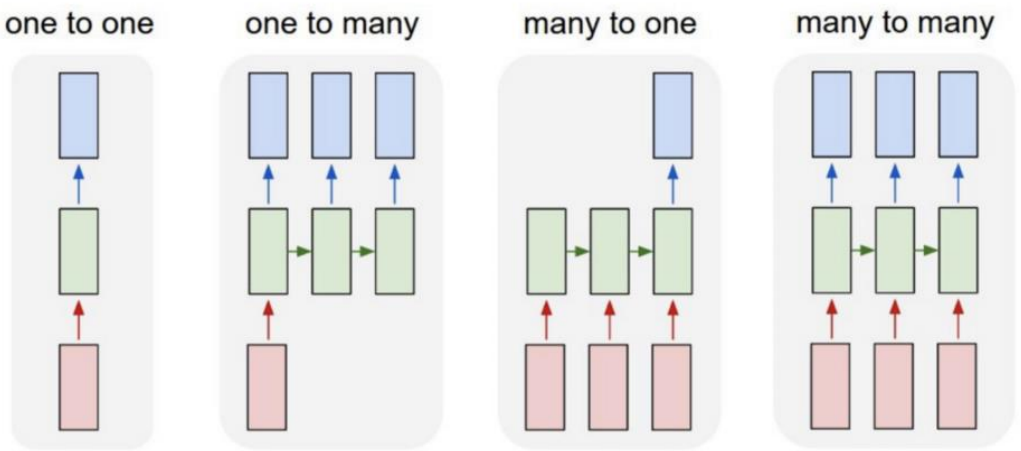
Deep neural network model

Recurrent Neural Networks (RNN) are a powerful and robust type of neural networks and belong to the most promising algorithms out there at the moment because they are the only ones with an internal memory.

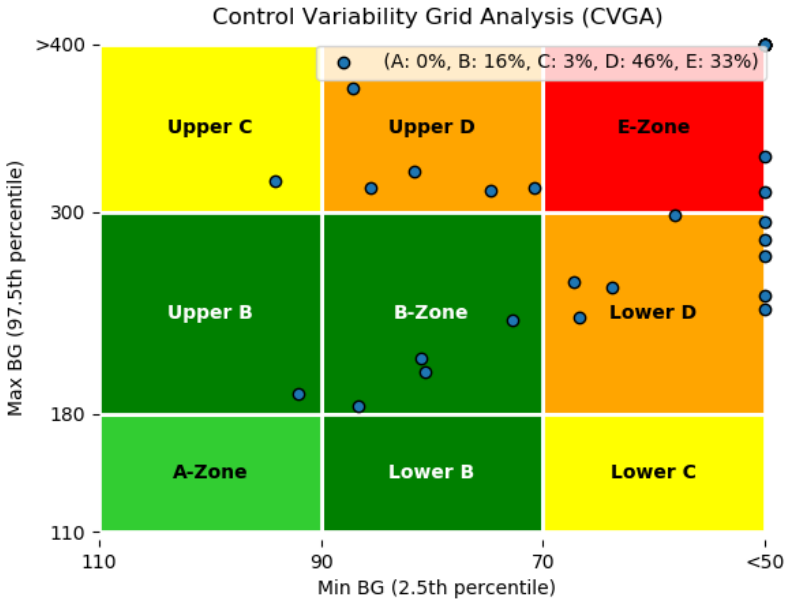
In a RNN, the information cycles through a loop. When it makes a decision, it takes into consideration the current input and also what it has learned from the inputs it received previously.

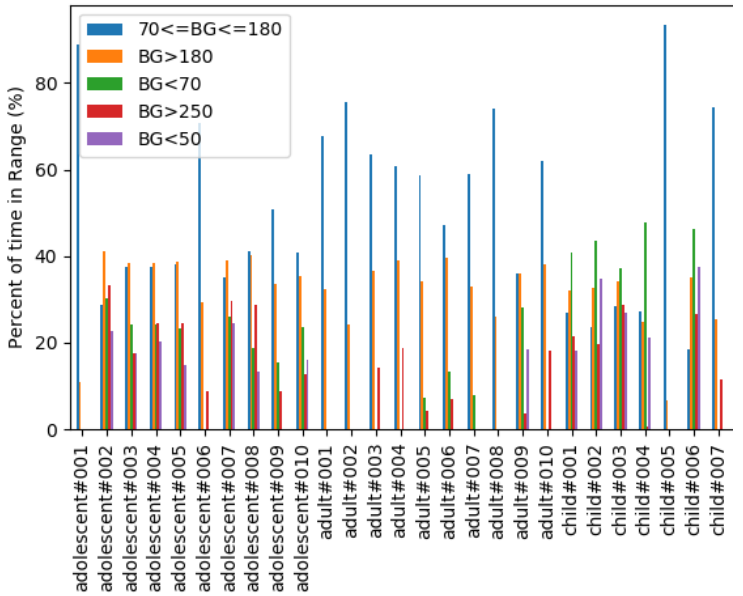
The two images below illustrate the difference in the information flow between a RNN and a Feed-Forward Neural Network.

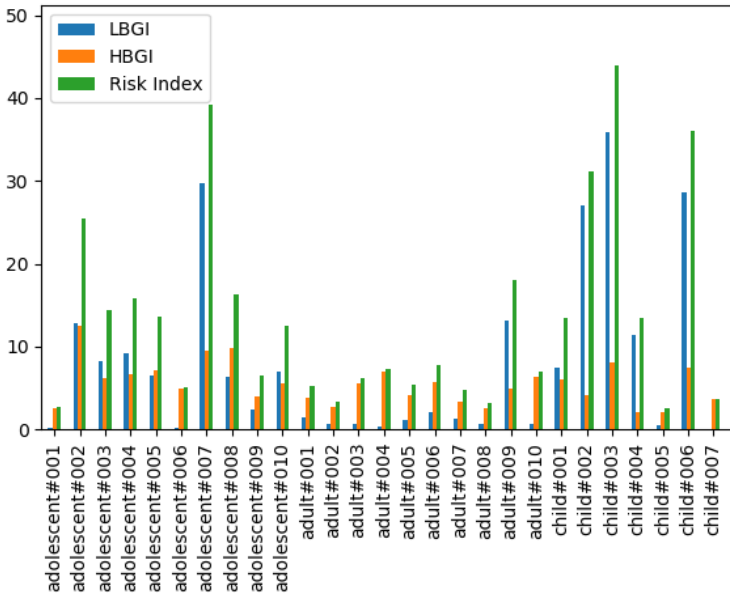


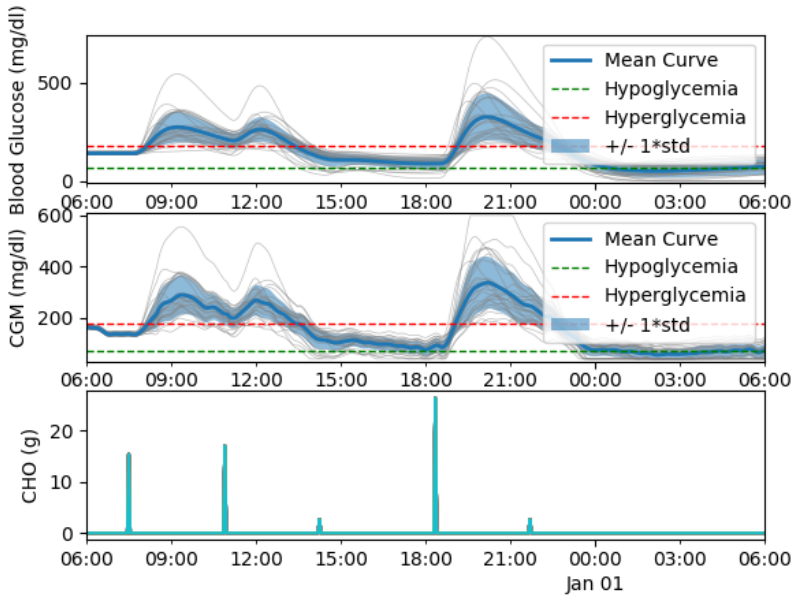


Recurrent Neural network based model


Control Variability Grid Analysis (CVGA)
(A: 0%, B: 16%, C: 3%, D: 46%, E: 33%)
Upper C
Upper D
E-Zone
Upper B
B-Zone
Lower D
A-Zone
Lower B
Lower C
Max BG (97.5th percentile)
Min BG (2.5th percentile)
>400
300
180
110
110
90
70
<50


70<=BG<=180
BG>180
BG<70
BG>250
BG<50
Percent of time in Range (%)


LBGI
HBGI
Risk Index


Mean Curve
Hypoglycemia
Hyperglycemia
+/- 1*std
Blood Glucose (mg/dl)
CGM (mg/dl)
CHO (g)
Jan 01

results