Novel custom computing solutions will enable the human body to power health monitoring devices.

Motivation – Suppose your doctor had advised you of a heart condition you might have.

Now - How would conventional methods check for this? Using medical technology now you would have to schedule several doctor visits, which cannot possibly find the occurrence and takes significant time/money.

Future - Pair a body sensor over a secure connection with your cell phone, which can in real-time detect all known conditions and save the data for your next doctor visit.
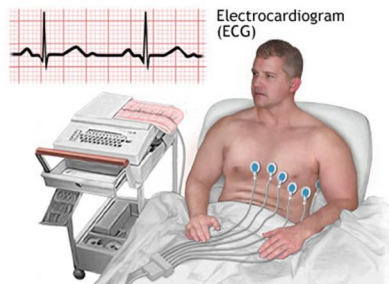

Fig. 1. Electrocardiogram (ECG) used in extracting shapelets from the heartbeat of a patient.
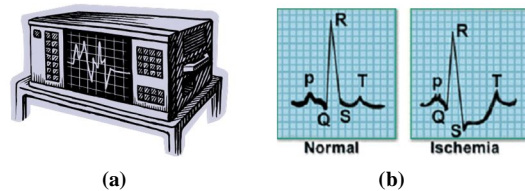

(a)   (b)

Fig. 2. (a) Electrocardiogram (ECG) used in extracting shapelets from a heartbeat. (b) Shapelets corresponding to normal heart blood flow and ischemia which is a restriction in blood flow; each shapelet consists of a P wave, a QRS complex, and a T wave.

Processor	Total Power (P_w, Watt)	Minimum Runtime (t_s, seconds)	Energy (E_j, Joules)
Standard	4.434 (0%)	1883 (0%)	8318.184 (0%)
State-of-the-Art	4.503 (+1.02%) ↑	544 (-346.14%) ↓	5110.905 (-38.58%) ↓
Our Method	4.566 (+1.03%) ↑	387 (-486.56%) ↓↓	1767.042 (-78.76%) ↓↓

Table 1. Microprocessor Configurations Comparison

The table compares the industry standard to the known state-of-the-art method and our method. Our method also reduces code size and enables similar research fields expand on our methods and techniques. Since we used a publically available data set other researchers can directly compare to our results. The data used is from real patient ECG readings with one million samples points.

cod, pod, dog, deadbeef
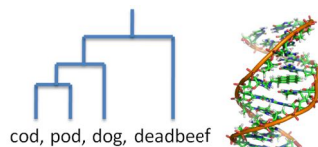
Other relevant applications include similarity search, which pertains to DNA matching/sequencing, facial recognition, hand-writing to computer document translation, image likeness, search engine, voice recognition, etc.

Potential – The prototype only shows the reduced energy and time for a 100 MHz clock. When hardening the system to cell phone requirement the frequency will be 1000 MHz; resulting in 10 times faster execution time and even more energy savings using advanced industry standard energy saving techniques. Further research in power scatter and gathering techniques will allow the processor and sensors to be reduced to a micro dot scale and be powered by the human body.

Bourns College of Engineering

Department of Computer Science and Engineering

Dr. Philip Brisk & Joseph Tarango

philip@cs.ucr.edu   jtarango@cs.ucr.edu

Fig 3. Intel-Altera donated development board.

(Philip on the left and Joseph on the right)