

Visualizing Heart Data from Pulse Intervals

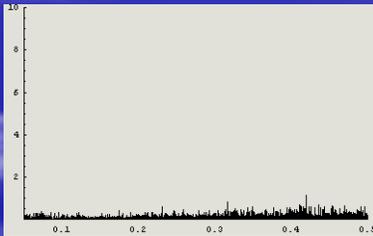
By
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What do researchers seek?

- To achieve a better understanding of the state of a living entity by analyzing time-series data taken from blood pressure
- Tools exist (e.g. Spectral analysis, Wavelet, etc.)
- These tools are nonetheless hard to interpret:
 - The high irregularity in the data set causes “noise” to show up, possibly hiding the juicy stuff

Typical Spectrum

- Clearly it is not so simple to infer things from something that looks like this:



What do researchers want?

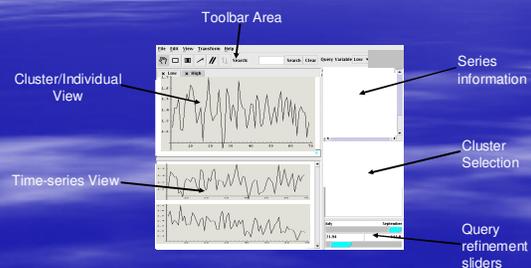
- To be able to look at the data in a way that is easier to interpret
- To have a means of classification of heart data based on the state of the ‘patient’
- As a consequence, diagnosis would become easier, and diseases might be prevented by early detection

The Proposed Solution

- Clustering on the (derived) pulse interval data as an attempt to classify;
 - A TimeSearcher-like application to visualize the data;
 - Query boxes would be useful in examining common features across clusters;
 - Zoom boxes would allow detailed examination of individual time-series.

The Proposed Solution

- The GUI is similar to that of TimeSearcher



What has been done

- ◆ Contacted the authors of TimeSearcher;
- ◆ Established (tentatively) the clustering algorithm to be used: Normalized version of the RMSD (average geometric distance);
- ◆ Partial GUI (based on Harry Hochheiser's source code)

The issues that make it hard

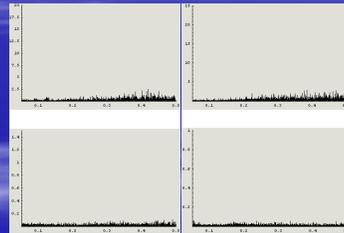
1. A typical series is roughly about 7,000 data points
2. Original data contains corrupted points due to monitoring machine calibration
3. Series do not all start at the same time! Expensive pre-processing may be required.
4. User feedback?

Possible solutions

1. Use neighbour averaging to represent several data points in one single point
2. Recover missing points by averaging the immediate neighbours.
3. Maybe there exists a representation that allows comparison independent of "starting" and "ending" points. The spectrum of each series is a candidate

Possible solutions

- One can notice similarities at first sight on the spectra:



- This is evidence that clustering is possible

Possible solutions

4. User feedback is definitely desirable. Will contact Bruce Van Vliet for this purpose

What has changed

BEFORE

- Series and clusters would be displayed with full detail
- Cluster view would allow querying on clusters only
- Allow zooming in cluster and individual views

NOW

- Averaging of data points will be done
- Cluster view allows switching to viewing all series in the clusters selected and vice-versa (querying on time series would then be allowed)
- An extra window will display time series in full detail to allow comparison with other series. Only display where zoom will be supported

What Next?

- Contact Bruce for user feedback
 - Implement clustering (including pre-processing)
 - Implement the display areas
 - Integrate with the existing querying implementation of TimeSearcher
 - Implement detailed view in separate window with zoom capabilities
 - Tune up the GUI
- Acknowledgements:
- Harry Hochheiser for kindly providing the source code of TimeSearcher
 - Bruce Van Vliet for kindly providing the data set