

ECG Visualization and Navigation

Sunics in Electrocardiology

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Sunics Research Laboratory Pty. Ltd.

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Part I

Technology

What is "Sunics" ?

- modelling and visualization of cyclic data
- compact, lossless representation of long data sequences
- reveals change of waveform morphology over time
- decouples waveform and frequency
- normalizes waveform to allow comparison.

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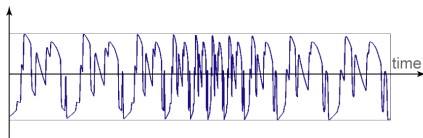
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So how are cyclic data sequences modelled and visualized ?

Modelling and Visualization Process



Given a data sequence with varying cycle lengths

Segmentation of data into cycles

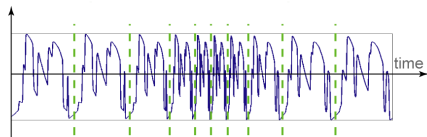
Normalization of cycles to segments of equal length

Rearrangement of segments based on time of occurrence

Completion to 2D surface, colour coding of data values

Projection to coloured 2D representation

Modelling and Visualization Process



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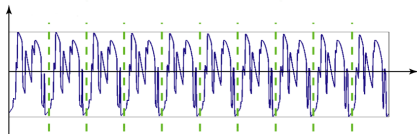
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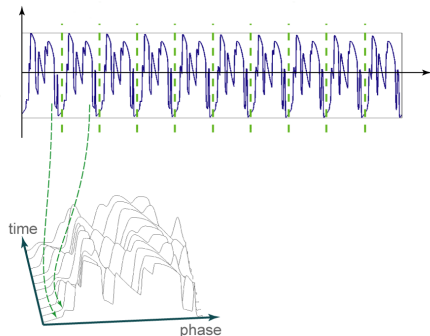
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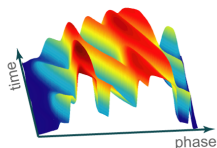
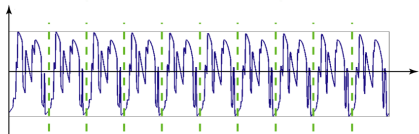
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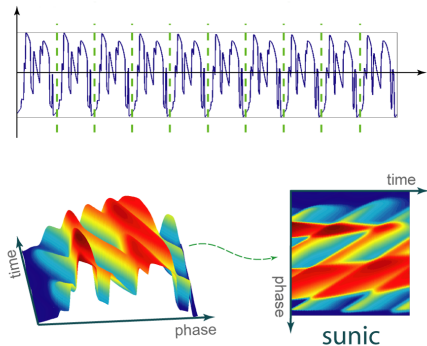
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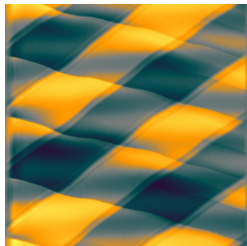
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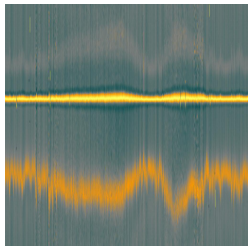
This process is applicable to many fields . . .

Accordion Sound



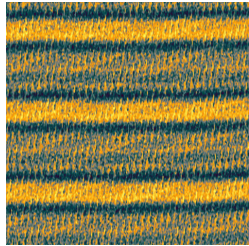
Audio

Stress Test ECG



Healthcare

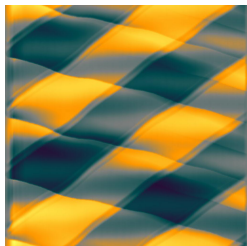
Bearing Vibration



Engineering

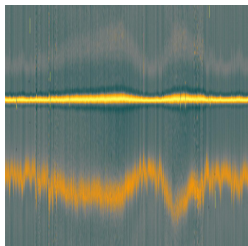
So let's explore the application to ECGs further ...

Accordion Sound



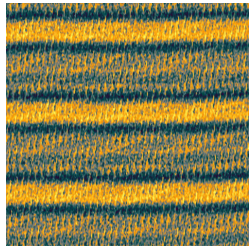
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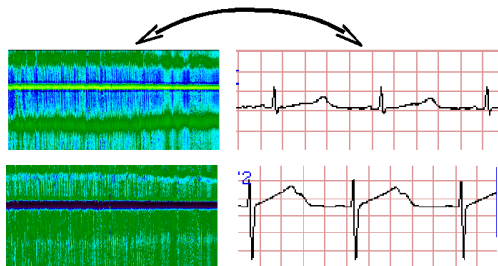
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Part II

Application to Electrocardiography

Applied to ECG data, Sunics improves and simplifies
assessment and management processes. . .

ECG Navigation during Assessment



(Simulation)

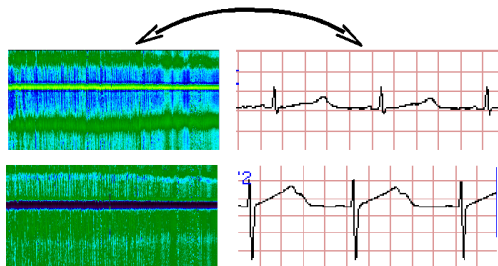
Overview: Sunic (left) shows entire recording (several hours), used for detection

Detail: ECG strip (right) shows a few seconds, used for assessment

Combination of displays allows for quick detection in overview and assessment via strip

Linking both displays provides a powerful, bi-directional navigation tool for assessment processes.

ECG Navigation during Assessment



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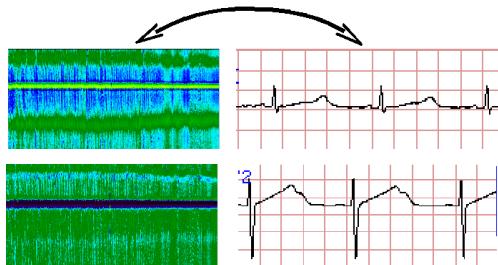
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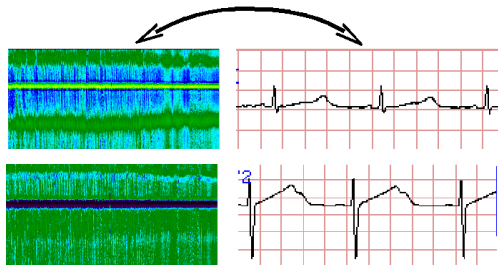
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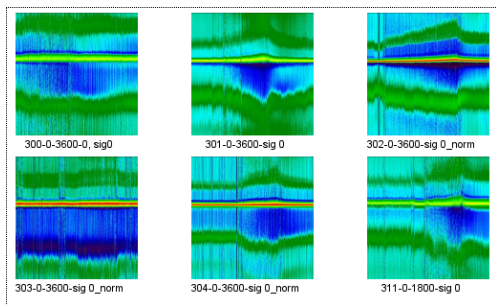
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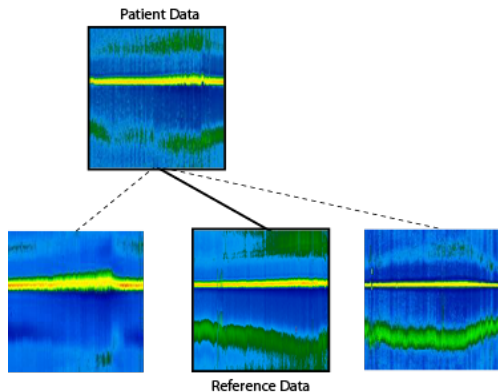
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Management – Visual ECG Index



Thumbnail icons allow for easy access to recordings managed in patient databases.

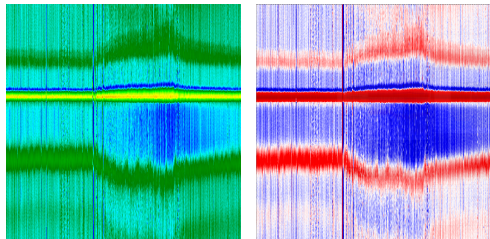
Comparison



Sunics allow for direct comparison of wave morphology, delivering a good base for automated processing.

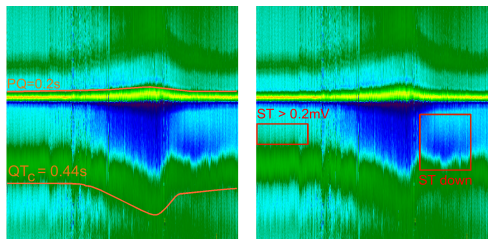
There are many ways to enhance or customize visualizations. . .

Choice of Colour Coding



A selection of colour codings can be used to suit user preferences.

Norm Values and Annotations



Clinical norm values and annotations can be overlaid, e.g.

- curves corresponding to $PQ = 0.2s$, $QT_c = 0.44s$
- regions where $ST > 0.2mV$
- regions with ST down slope.

Part III

Features and Benefits

Related Technology

- There are similar visualization techniques for ECGs ...
- ... the most similar being the Contourogram (G. N. Webb, 1964)
- How does this compare to Sunics ?

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Sunic (2005)

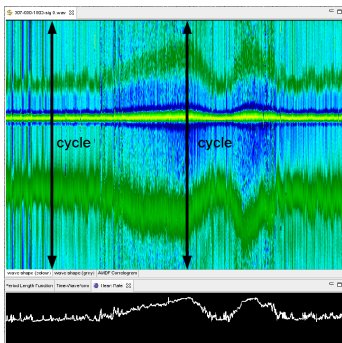


Image column corresponds to
one cardiac cycle

Contourogram (1964)

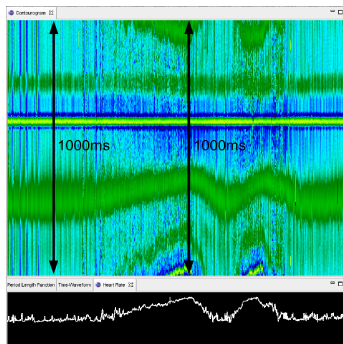
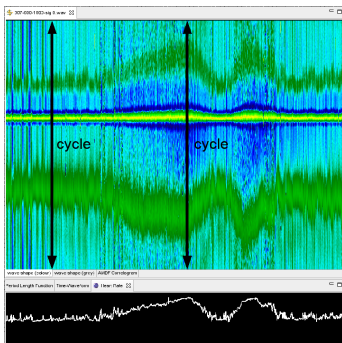


Image column corresponds to
fixed time window

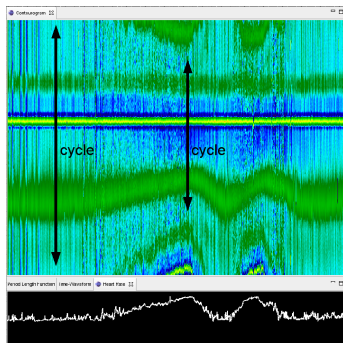
Interpretation of image columns

Sunic (2005)



Cardiac cycle corresponds to
image column, immediately
recognizable

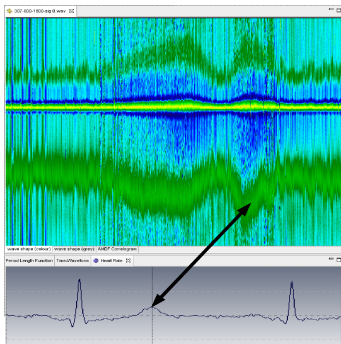
Contourogram (1964)



Cardiac cycle only recognizable
via interpretation of image
features

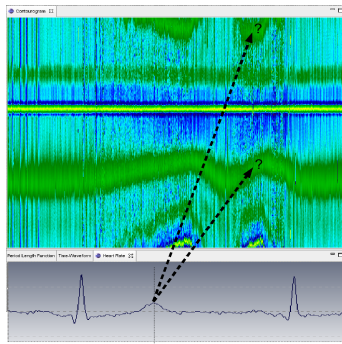
Recognizing cardiac cycle start and end

Sunic (2005)



Unambiguous correspondance
between strip and image

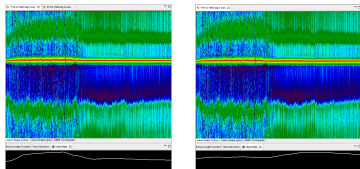
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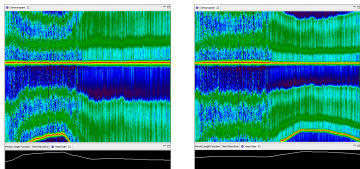
Navigating between strip and image

Sunic (2005)



Decoupled from heart rate

Contourogram (1964)

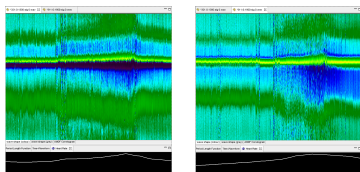


Coupled with heart rate

Relation between wave morphology and heart rate

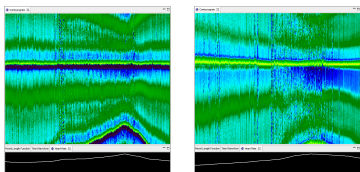
Simulation shows two recordings with equal morphology but different heart rate

Sunic (2005)



Similarities in waveshape morphology are reflected – allows for direct comparison

Contourogram (1964)



Similarities distorted by heart rate differences – no direct comparison

Manual or automated comparison of wave morphology

Simulation shows two recordings with similar morphology but different heart rate

Summary

Applied to ECGs, Sunics provides:

- Navigational overview for assessment of long term ECG
- Visual index for managed ECG data
- Base for automated comparison or assessment of long term ECG.

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Thank You

For more information, please visit
<http://www.sunics.com>