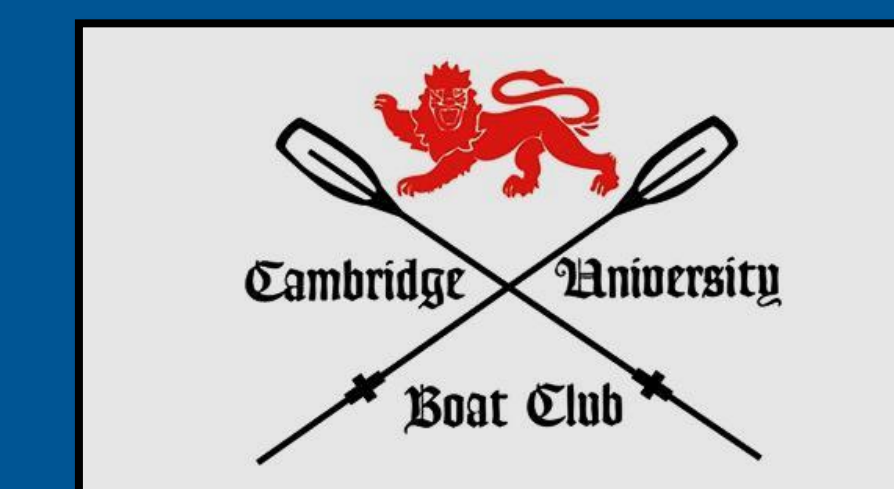


A novel method of chest wall movement analysis using Structured Light Plethysmography: A study on Elite Athletes vs “Normal” Subjects.

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Introduction

- Structured Light Plethysmography(SLP) and the SLP-based, the Thora 3Di™, is a non-invasive, non-contact method of assessing the movement of the rib cage and abdominal wall. SLP projects a grid of light onto the subject’s chest and abdomen, the movement of the grid allows both the analysis of compartment volume change and assessment of the surface motion.
- We present a novel method of breaking down the surface motion of tidal breathing that we believe to be able to characterise a subject’s healthy, diseased, or highly trained state.
- Aims and objectives: To use tidal breathing measurements to analyse respiratory movements and to categorise according to specific patterns.

Methods

- Tidal Breathing data was collected from 7 elite rowers after exercise (av Age 22) -- this was compared to 18 non-athletes otherwise healthy) (av Age 22)
- Surface modes for each subject were obtained using a tensor decomposition technique and used as characteristics of elite-athlete vs normal. The modes represent characteristic surfaces which each move according to given amplitude-time curves, and which combine linearly to make up the whole surface breathing pattern over time.
- Each dataset was classified using the other datasets as training data..



Figure 1: Data collection using the Thora 3Di™

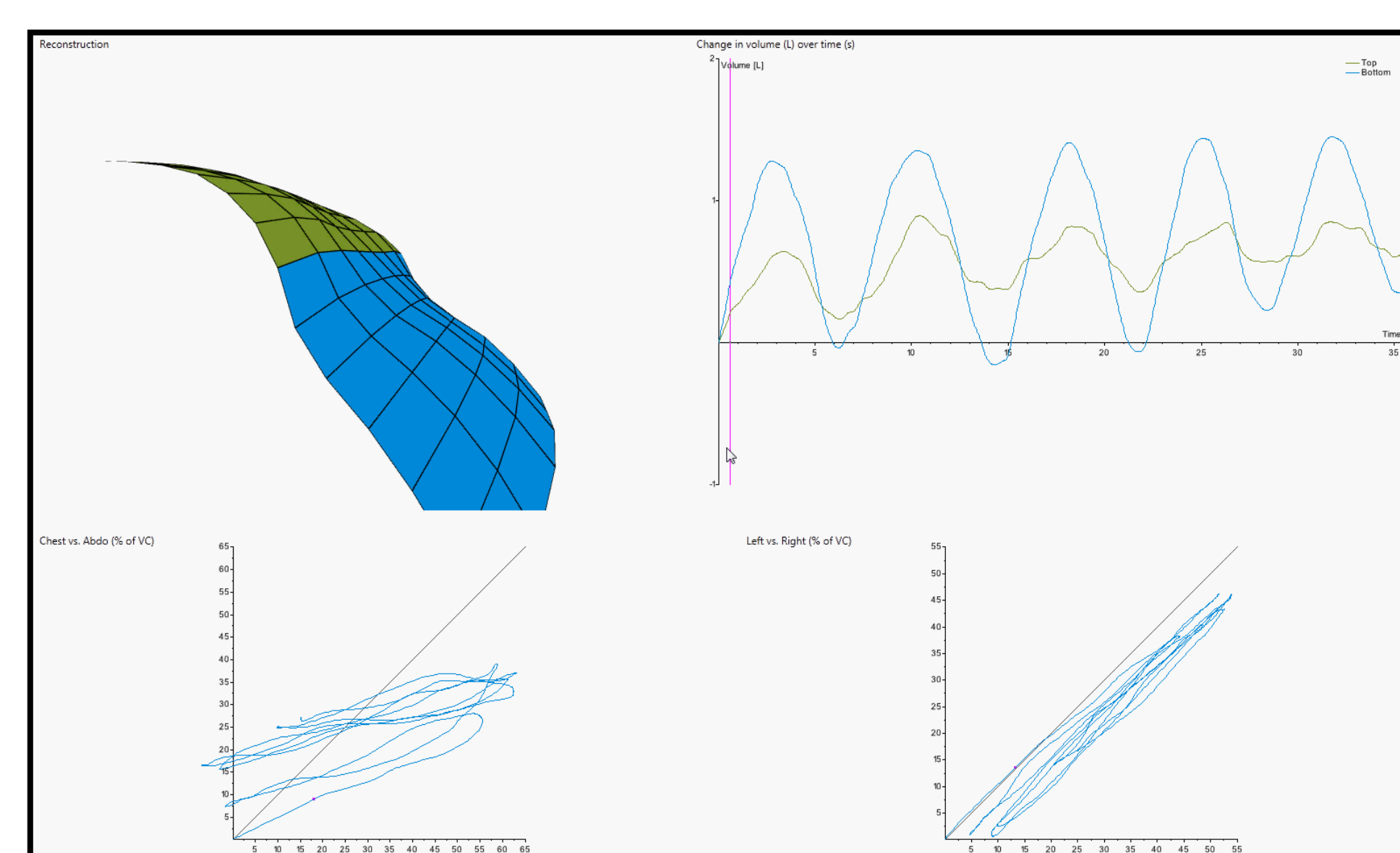
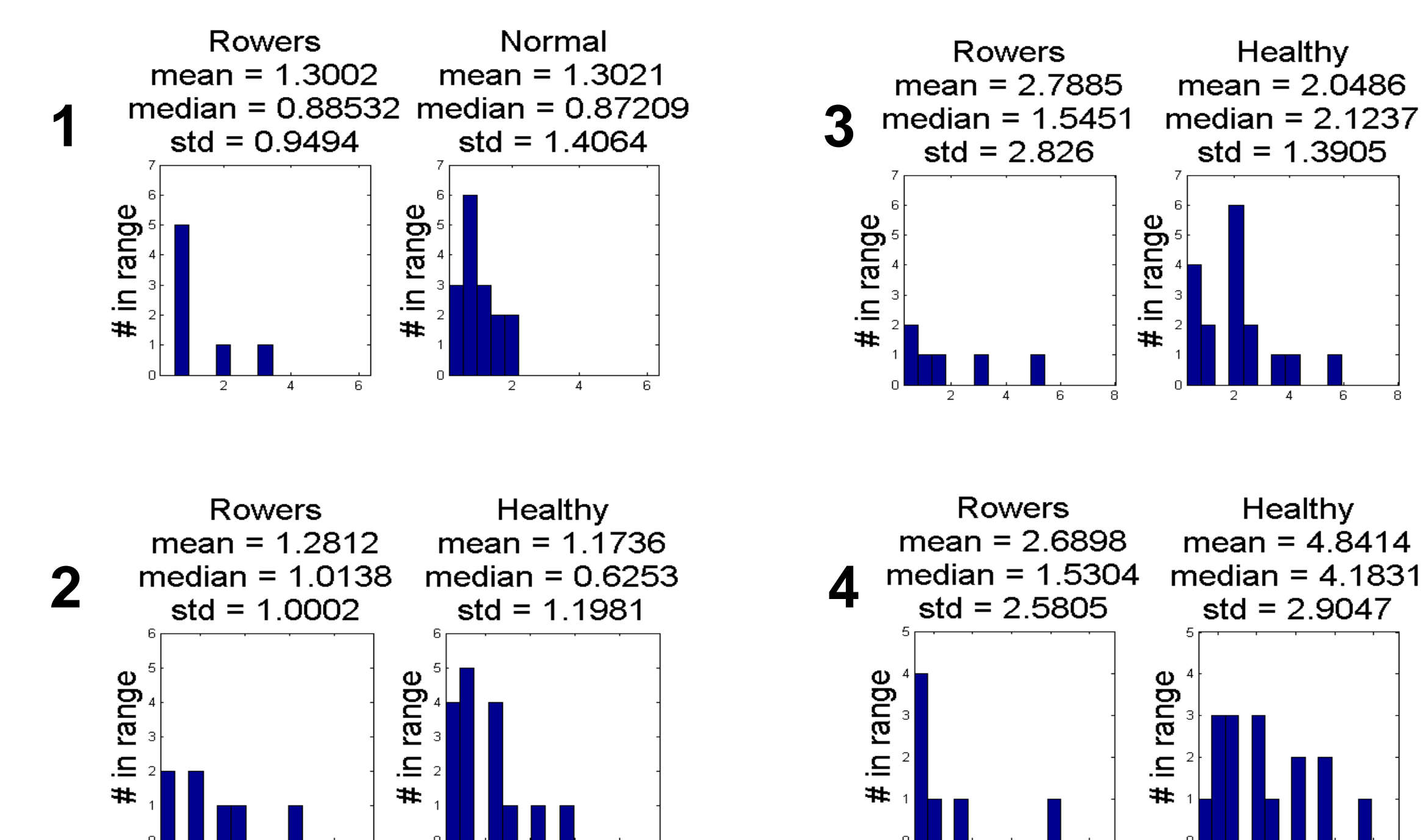


Figure 2: Sample output from Thora 3Di™ showing thoraco abdominal components of tidal breathing and KM plots.

Results

- 100% rowers being classified as rowers and 76% of normals being classified as normals for an overall 87.88% correct classification rate.
- For elite athletes there is a clear delineation of movement into pulmonary rib cage, abdominal rib cage and abdomen, while other normal subjects exhibit a predominantly two compartment movement

Figure 3: Graphical representation of Modes 1,2,3,and 4



Conclusions

- Analysis of chest wall movement clearly indicates specific differences between the breathing patterns of elite athletes and normal non-athletes.
- The rowers have more complex breathing, with multiple sections of the chest moving separately, rather than in sync.
- This complexity leads to more structure in the lower two modes.
- The rowers are also very symmetric in their breathing patterns.
- Or best guess is that with greater fitness, especially in this case, comes better muscle control, which results in the symmetry we see.
- Surface movement analysis of other subject groups will be investigated as a next stage.

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