DOCTORAL CANDIDATE:	
DEGREE:	Philosophiae Doctor
FACULTY:	The Faculty of Mathematics and Natural Sciences
DEPARTMENT:	Departmen of Informatics
AREA OF EXPERTISE:	Image processing
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DISSERTATION TITLE:	*Segmentation of Cardiac Structures in 3-Dimensional Echocardiography*

Ultralyd er et av de viktigste verktøyene leger bruker for å sjekke hjertet ditt. I dag bruker kardiologer stort sett vanlig 2-dimensjonal ultralyd, noe som dessverre gir et veldig snevert bilde av hjertets komplekse struktur. Derfor har vi utviklet matematiske metoder som lar kardiologene automatisk hente ut klinisk informasjon om hjertets form og funksjon, basert på moderne 3-dimensional ultralyd. Metodene er brukt til kvantifisering av funksjonen til hjertets hovedkamre, samt planlegging av en minimalt invasivt prosedyre for bytte av hjerteklaff.

Ultrasound is one of the most important tools doctors use to assess your heart. Normally, cardiologists use 2-dimensional ultrasound, which shows you what the heart looks like if you were to “slice” through it. Although this is a great tool, it doesn’t let you properly appreciate the real and complex shape of the heart, as you cannot see what lies outside of this “slice” through the heart.

In the past decade or so, 3-dimensional ultrasound has been making its way onto the market. Although this technique allows clinicians to capture the full anatomy, adoption into clinical practice has so far been very limited. This is in large part due to the vast increase in information when going from a 2-D image to a 3-D image, as well as challenges relating to image quality. Interpreting such 3-D images is hard, and without computer guidance, clinicians often fail to perform reliable measurements.

In this thesis, we present computer algorithms that were designed and developed to extract the shape and function of different parts of the hearts anatomy. With these methods, the clinician can extract the geometry of the anatomy of interest from a 3-D ultrasound image within seconds, and use this geometry to quantify the shape and function of the heart.

We demonstrate how these methods can be applied in two main clinical cases. Firstly, we show that they can be used to quantify the pumping function of the heart’s main chambers. Here, we specifically focus on one of the most challenging – and often overlooked – chambers of the heart. Secondly, we show that the methods can be used to select the size of a prosthetic aortic valve before performing a minimally invasive valve replacement procedure.