Project Proposal: Image Segmentation for Ultrasound

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bk ultrasound

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Project Proposer

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  - Bell Labs, Ireland 2010-2012
  - Ph.D., Trinity College Dublin 2012-2015
  - BK Ultrasound 2015 –

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- BK Ultrasound
  - Danish Company
  - ~100 employees in Herlev
  - Develops and builds ultrasound scanners (hardware, software, mechanics)
  - Specialized in urology, with a large world-wide market share
  - Also market-leading in surgery and neurology
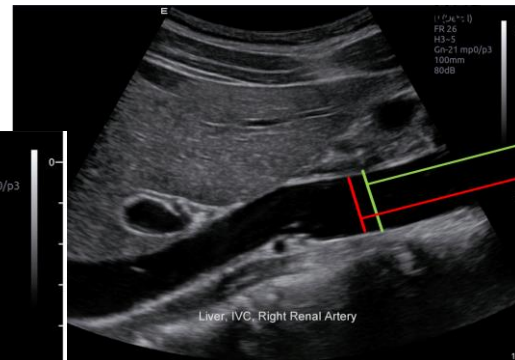
  - www.bkultrasound.com

Problem

When making measurements (e.g., blood flow volume or mass sizes) in ultrasound images, the operator must manually select measurement points.

But:

Is this the correct vessel diameter (outside) …

… or is this (inside)?

Is this the best approximation to cyst volume …

… or is this?

Exactly how measurement points are placed is largely operator dependent. Thus, if two exams are done by different operators, results may be different.

Problem II

- Why this matters:
  - Measurements taken months apart are used to determine treatment
  - Whether a mass (cyst or tumor) is growing or shrinking can determine whether a patient needs surgery or cancer therapy
  - Whether blood flow or plaque buildup in an artery is stable or not determines whether vascular surgery is needed

- Having a stable mechanism for measurements would prevent unneeded therapy and ensure that therapy is given when needed

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Proposed Solution

- Automatic, robust, real-time image segmentation
  - Use image processing algorithms in the ultrasound scanner to find the features in the images
  - Produce comparable measurements from different scanning sessions regardless of operator preferences

- Algorithm research department at BK Ultrasound have identified a good candidate for segmentation algorithm
  - Method published and freely available
  - Reference implementation available

- We need a fast, OpenCL-based implementation

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Project Proposal

- Analyze the image segmentation algorithm, apply optimizations learned in PMPH, and implement in Futhark

- Compare speed and quality of produced segmented images and evaluate whether the algorithm is suitable for real-time use