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AREA OF EXPERTISE:	Medical robotics
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DISSERTATION TITLE:	*A semi-autonomous robotic system for needle tracking and visual servoing using 2D medical ultrasound*

Methods for tracking biopsy needles in medical ultrasound images, a step towards autonomous robotic cancer diagnostics and treatment.

This PhD thesis by Kim Mathiassen has two main results; the development of a robotic medical ultrasound system and methods for tracking a needle using medical ultrasound. One future use of the results may be in autonomous robotic cancer diagnostics and treatment.

Medical ultrasound is an important tool in modern medicine and is widely used in both diagnostics and treatment. Inserting a needle through the skin (percutaneous needle insertion) is a common procedure monitored using medical ultrasound. This includes insertion of biopsy needles and ablation probes. Using a biopsy needle the physician takes a tissue sample of a suspected malignant lesion (i.e. cancer diagnostics). An ablation probe is inserted into a cancer tumor to destroy the pathological area by the application of energy (i.e. cancer treatment).

In this thesis a robotic system is developed using commercially available components. The robot holds an ultrasound probe. The system may be used to monitor the insertion of a needle into the patient's body. Novel methods have been develop to track the needle in real-time as either a human or a robot inserts the needle. Experiments with both human and robotic insertion of a needle into an ex vivo tissue has been conducted, and the results show that the needle is accurately tracked. In the future the estimated needle position and orientation may be given to a robot that inserts the needle, to ensure that the needle hits the correct target. This opens up the possibility for automating needle insertion task in health care, although many challenges still remain.

Norwegian intro:

Denne doktorgradsavhandlingen skrevet av Kim Mathiassen har to hovedresultater. Det første er utviklingen av et robotsystem for medisinsk ultralyd. Det andre hovedresultatet er utviklingen av metoder for posisjons- og retningsestimering avbildet ved bruk av medisinsk ultralyd. Fremtidig bruk av denne teknologien kan være innen autonom diagnostikk og behandling av kreft ved bruk at robotteknologi.