Master track Medical Imaging and Intervention

LeakAId - We've got your gut

Group 1; Nadine Coorens, Myrthe Wennen, Marijn Hiep, Freek Bielevelt, Andrea Sterkenburg, Judith Troost

Abstract:
As a gastrointestinal surgeon, you might relate: 1 out of 10 of your patients will end up with an anastomotic leakage (AL) after a low anterior resection (LAR). This complication leads to serious problems: patients become awfully sick, need a long-term stay at the Intensive Care Unit, healthcare costs increase excessively, and above all, there is a frightful mortality rate of 39%.
To date, this mortality rate has been very difficult to overcome, mainly due to the unpredictable character of AL. Among other things, several scoring systems based on risk factors have been prepared to help surgeons in their mostly subjective decisions, but these still fail to show their clinical value in a consistent and reliable prediction of AL.
LeakAId, a “self-thinking” predictive software for anastomotic staplers based on artificial intelligence, was designed using a total different approach to fight this problem. LeakAId is a software product for specific compatible circular staplers, trained by all available data from all over the world. It provides an intraoperative prediction for AL immediately after the construction of the anastomosis, allowing the surgeon to make a more considered decision in the consideration to create a stoma. In this way, LeakAId can prevent anastomotic leakages to an extent never reached before: the occurrence of AL could be decreased by 30%.

EssentialReveal1.0

Group 2; Tsjitske Bannink, Annabel Groenenberg, Thomas van Kuipers, Jelle Man, Marell Niekolaas, Meike van Wijk

Abstract
Robotic surgery has caused revolutionary changes in the medical urological industry, which offer a whole new spectrum of possibilities in radical prostatectomy. However, some challenges have not been faced yet, such as the steep learning curve for operating a robotic system and keeping an overview on the anatomy while having a limited view. ESSENTIALreveal will be the innovation that robotic surgery needs to overcome these hurdles. The software will use a form of artificial intelligence, namely convolutional neural networks, to detect and label on-the-spot anatomical structures along with superficially underlying anatomical structures. This could prevent complications in patients while it could have a great impact on the learning curve of trainees and on the productivity of experienced surgeons as well. Therefore, further development of the ESSENTIALreveal software is expected to cause a significant cost reduction and better outcome for patients in RARP procedures.

Visualisation of a Tumour during Robotic Surgery with Artificial Intelligence

Group 3; Bo Berends, Wouter ten Bolscher, Carmen van Egmond, Quinten Eyck, Jelbrich Sieswerda, Nynke de Vries

Abstract
The use of artificial intelligence (AI) is an issue of great interest in almost every facet of modern life. AI has been adapted slower in health care than in other fields, but the pace of implementation of the research currently accelerates impressively in health care. This report focuses on the implementation of AI to visualize tumours during surgery. As a starting point, tumours of the kidney are chosen, because the kidney moves little and is therefore the easiest organ to tackle first. Tumours of the kidney are often removed surgically, but with the risk of positive surgical margins (PSM). Visualisation of the tumour would reduce the chance of PSM and therefore reduce the recurrence rate, risk of death, reoperations and lower medical costs.
To achieve this visualisation, two methods using image registration and convolutional networks are posed under the name of *nephro-g**AI**dance.* Lastly, a business case is presented for this company and the opportunities for *g**AI**dance*, appliance of the technology on other organs.

Invitation for presentation 'False aorta lumen'

Group 4; *Nicolaas Bekedam, Ruby Egging, Lianne Feenstra, Denise Hoogenkamp, Anne Rook, Daan Schouten*
Group 5; *Lars Bannink, Rianne van Rijswijk, Tess Snoeijink, Jasper Twilt, Wouter Versluis, Desi ter Woerds*
Group 6; *Marit Buitenhuis, Iris Laven, Camiel Smees, Angelica Steenhuis, Ivar Wamelink, Sanneke Willekens*

Abstract
The last 6 months a group of 18 Technical Medicine students has been working on a case from professor Geelkerken, vessel surgeon at the Medical Spectrum Twente (MST) and professor at the University of Twente. The students were divided into three groups, which all three worked on an interesting part of this case. The main goal was to "gain insight in pre-, per- and post-operative factors that influence the outcome in patients with type B aortic dissection after thoracic stent placement."

The first group had a subject about the design of a computer model that can predict whether a patient has an increased risk to develop complications after surgery. This study consists of two parts. Part A focuses on creating a computer model that investigates the ratio between the true and false lumen relative to the trajectory of the aorta as a predictor for patients outcome. Part B focuses on different parameters that are needed to improve hemodynamic flow simulation in the aorta by means of a computer model.

The second group tried to determine the influence of the aortic arch curvature on the wall apposition of the stent after stent placement. This is an interesting objective, because aortic arch curvature could possibly predict postoperative stent-graft failure after aortic repair in type B aortic dissection. With a phantom of the aortic arch, different arch forms were observed and assessed with X-Ray imaging. By this we tried to increase the insights in the curvature - stent apposition correlation for future stent optimization. In addition, in the ideal situation the observed correlation can be included in the Machine Learning model described by group three.

The final group did their research about Machine Learning. Our current society records everything and the enormous companies use this information in their benefit. Clinicians are not far behind and are also starting to use recorded data to diagnose patients. We tried to find parameters in literature which affected the outcome of type B aortic dissection interventions. These parameters, together with the outcomes of previous patients can be inserted in a deep learning model. Not only these parameters will be implemented, but also the parameters from the other two groups will be useful in this model.

Silent Speech Recognition for patients with laryngectomy using a combination of EMG and video recordings

Group 7; Renée Hovenier, Lennard van Karnenbeek, Anouk Verschuur, Robbert Wiggers, Annemiek ter Brugge

Abstract:
In the Netherlands, each year approximately 150 patients undergo a laryngectomy. Most of these patients do not only encounter problems with breathing, but also problems with speaking as their vocal cords are removed. This results in communicating problems and isolation. To prevent this, automatic speech recognition (ASR) may provide a solution. Two highly investigated applications for this are the use of EMG data or video recordings. The aim of this study is to determine whether the combination of EMG data and video recordings leads to a more reliable speech recognition. To investigate this, data analysis is performed using various machine learning methods. The results show that the combination does not improve speech recognition compared to both methods solely. However, an important limitation is the use of a small dataset, which makes the results less reliable.

development of an application for the production of audible sound using visual speech recognition.

Group 8; Dana Bokhoven, Iris Hamelink, Eva de Ronde

Abstract
Background - For laryngeal cancer patients who had a total laryngectomy it is difficult to restore the ability to talk, since the vocal chords are removed and the connection of the airways and the mouth is lost. To make it possible for these patients to have conversations without any prostheses, a silent speech interface needs to be developed. The goal of this article is to define the requirements of a silent speech interface for these laryngectomy patients and to set the first steps in the development of such a technique.
Methods – First a stakeholder analysis will be conducted. After this, a questionnaire will be made and will be presented to the stakeholders to find the requirements of a silent speech interface. At last, these requirements will be translated into a design. The first steps of the development of this design will be carried out in this article, further steps will only be discussed.
Results and conclusion – The requirements of a new silent speech interface according to the stakeholders are: little delay between the device and the patient, easy to use and the production of a natural voice. Based on these requirements, video images of the lips were chosen as input. For the recognition of the lips, different segmentation methods were evaluated. In the future, this could be used to recognize the movements of the lips and translate this into audible sound.