



## **RASimAs: Prvé excelentné výsledky!**

**Erik Smistad a Frank Lindseth z oddelenia medicínskych technológií organizácie SINTEF v Nórsku boli ocenení na konferencii MedViz 2015.**

V roku 2013 poskytla Európska únia v rámci 7. rámcového programu grant 3,3 milióna EUR pre projekt RASimAs (z angl. "Regional Anaesthesia Simulator and Assistant" – simulátor a asistent lokálnej anestézie), ktorého cieľom je urobiť v Európe z lokálnej anestézie štandardný prístup v starostlivosti o pacienta. Lokálna anestézia má jednak množstvo výhod pre samotného pacienta (rýchlejšia príprava na operáciu, skoršie prepustenie z nemocnice), ale aj významné ekonomické následky (možné ročné úspory až 100 000 EUR na jednu operačnú sálu v rámci Európy).

Do projektu RASimAs sú zapojení odborníci z 10 európskych krajín z akademickej (vedci a výskumníci venujúci sa informatike a virtuálnej realite), firemnej (špecialisti vo vývoji medicínskych zariadení) a klinickej sféry (odborníci v oblasti anestézie). V polovici projektu, ocenila vedecká komunita prvé excelentné výsledky.

Erik Samistad, mladý výskumník z Nórska a člen tímu pracujúceho na projekte RASimAs, prezentoval príspevok vo forme plagátu na konferencii MedViz 2015, ktorá sa konala 15. a 16. júna 2015 v Bergene v Nórsku. MedViz „od vízie k cieľu“ spája rôzne skupiny odborníkov, venujúcich sa interdisciplinárnemu výskumu v pokročilej analýze obrazu a vizualizácii, ktorí uvádzajú teoretické výsledky do praxe. Erik prezentoval nové metódy segmentácie štruktúr, akými sú stehenná cieva a stehenný nerv v ultrazvukových snímkach stehennej oblasti, spolu s registráciou 3D modelu, používaného pre navigáciu používateľa (lekára) k cieľovej oblasti, čo predstavuje kľúčovú časť nástroja vyvíjaného v rámci projektu RASimAs. Tieto metódy boli vyvinuté pod vedením dr. Franka Lindsetha, senior výskumníka v organizácii SINTEF.

„Od prvého momentu som bol fascinovaný myšlienkou projektu RASimAs, ktorý má spojiť najmodernejšie poznatky z oblastí algoritmov, hardvérových technológií a medicínskych modelov pre dobro pacientov,“ hovorí Erik, ktorý nedávno dokončil svoju dizertačnú prácu zaoberajúcu sa segmentáciou medicínskych snímok pre zdokonalenú chirurgickú navigáciu a v súčasnosti je zamestnancom oddelenia medicínskych technológií v organizácii SINTEF v Trondheime v Nórsku. „Keď som dostal ponuku pracovať na tomto projekte, bol som nadšený a hneď som ju prijal.“ „Sme radi, že Erik sa pripojil k nášmu tímu, keďže svojou prácou prispieva k najnovším poznatkom v oblasti medicínskych vied a technológií,“ dodáva dr. Frank Lindseth z organizácie SINTEF, ktorý pomáhal Erikovi pri jeho dizertačnej práci. Prof. dr. Thomas Deserno z Uniklinik RWTH v Aachene v Nemecku, ktorý vedie projekt RASimAs, dodal počas blahoželaní Erikovi a Frankovi za ich vynikajúci výskum: „Je isté, že sa nejedná o posledné ocenenie, ktoré sme získali za inovácia dosiahnuté v rámci projektu RASimAs.“

### Informácie k projektu RASimAs:

Ref. číslo: FP7 ICT-2013.5.2, No 610425  
Web: [www.rasimas.eu](http://www.rasimas.eu)  
Twitter: @rasimasEU  
Facebook: [www.facebook.com/rasimasEU](http://www.facebook.com/rasimasEU)  
Mail: [deserno@ieee.org](mailto:deserno@ieee.org)

### Kontakt:

Prof. Dr. Thomas M. Deserno  
Department of Medical Informatics  
Uniklinik RWTH Aachen  
Pauwelsstr. 30, 52057 Aachen, Germany  
Tel.: +49 241 80 88793





### An assistant for improved ultrasound-guided regional anaesthesia of the femoral nerve

Erik Smistad<sup>1,2</sup> and Frank Lindseth<sup>1</sup>  
 1. SINTEF Medical Technology, Trondheim, Norway  
 2. Dept. of Computer and Information Science, Norwegian University of Science and Technology

SINTEF NTNU – Trondheim  
 Norwegian University of Science and Technology

**Introduction**  
 The use of regional anaesthesia (RA) is increasing due to the benefits over general anaesthesia (GA) such as reduced mortality and morbidity, reduced postoperative pain, earlier mobility, shorter hospital stay, and lower costs. Despite these clinical benefits, RA remains less popular than GA. One reason for this is that GA is far more successful and reliable than RA. Ultrasound has been employed to increase the success rate of RA. However, ultrasound-guided RA can be a challenging technique, especially for inexperienced physicians and in difficult cases. Good theoretical, practical and non-cognitive skills are needed in order to achieve confidence in performing RA and to keep complications to a minimum. Studies indicate that RA education focusing on illustrations and not alone is not sufficient.

The RASimAs project (Regional Anaesthesia Simulator and Assistant) is a European research project which aims at providing a simulator to improve the training of doctors performing RA, as well as an assistant to lessen the cognitive burden and help performing RA procedures. The assistant will guide the user to 1) find a good probe placement and view of the target injection site, 2) insert needle and 3) inject local anaesthesia. In step 1, segmentation of the structures of interest and registration of the 3D model will be used to guide the user to the target area. These tasks will be given to the user including which direction the probe should be moved to reach the target area. After the target area has been located, the assistant will guide the needle insertion by visualizing the needle in both the ultrasound image and the 3D scene. In the final step, the user tracks local anaesthetic which will be displayed in the annotated ultrasound image. Although the assistant is applicable for different ultrasound-guided RA workstations, the focus in this project has been on the femoral nerve (see figures 1 and 2).

**Methods**  
 The ultrasound system consists of an Analogic Sonic MCP scanner with a linear probe and electromagnetic tracking (E-tracking) of both probe and needle. The images are obtained in the assistant using the Plus tool and the OpenCLike protocol. In the automatic vessel segmentation and registration methods have been developed for the assistant. The vessel is detected and tracked automatically in real-time using an elliptical vessel model, a Kalman filter and a particle processing and GPR. A main result of the automatic anatomy was created from a CT dataset. Registration of the model is achieved by first detecting the ultrasound image frame and the target site. After this identification, each ultrasound image frame is registered to the artery model using the detected centreline from the vessel tracking. If any bone is detected in the images, it is used to register the model in the tracked direction. The registration and registration methods must be able to process the images in real-time to be useful for the femoral nerve block workstation. This is achieved by implementing the assistant with the FAST framework which uses GPU and OpenCL for processing and visualization. Figure 3 shows a diagram of the different parts of the assistant.

**Results**  
 A total of 22 ultrasound image sequences from 3 subjects were collected. The number of images per sequence ranged from 133 to 124. For each sequence, the vessel was manually segmented in 8 randomly selected frames. The vessel detection indicated the tracking successfully in all 22 sequences. On average, the tracking was successfully initiated after the vessel detection was on 18 frames. Assuming 20 frames per second, the tracking is initiated in about 1.6 seconds. The vessel tracking algorithm achieved an average slice similarity coefficient of 0.90, mean absolute distance of 0.42 mm, and Hausdorff distance 1.17 mm. The average runtime was measured to be 42, 5, 0.21 and 34 milliseconds for the vessel detection, tracking, registration and bone segmentation methods respectively. Figures 4 and 5 show some results of the vessel segmentation and registration methods.

**Conclusion & future work**  
 The presented methods are able to automatically and accurately track the femoral artery in ultrasound images and use this to register a model of the surrounding anatomy in real-time. This will be part of an assistant for ultrasound-guided regional anaesthesia of the femoral nerve. Currently, we are working on registration of the femoral nerve, brachial plexus and brachial plexus base (see Figure 6), needle insertion guidance and enhancement of the local anaesthetic after insertion. In 2016, the assistant will be clinically tested and evaluated at three different sites.

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 610425.

## Ocenený príspevok prezentovaný na konferencii MedViz 2015



**Erik Smistad a prof. Antonella Zanna Munthe-Kaas, predsedníčka posterovej sekcie na konferencii MedViz 2015**

**Informácie k projektu RASimAs:**

Ref. číslo: FP7 ICT-2013.5.2, No 610425  
 Web: [www.rasimas.eu](http://www.rasimas.eu)  
 Twitter: @rasimasEU  
 Facebook: [www.facebook.com/rasimasEU](http://www.facebook.com/rasimasEU)  
 Mail: [deserno@ieeee.org](mailto:deserno@ieeee.org)

**Kontakt:**

Prof. Dr. Thomas M. Deserno  
 Department of Medical Informatics  
 Uniklinik RWTH Aachen  
 Pauwelsstr. 30, 52057 Aachen, Germany  
 Tel.: +49 241 80 88793

