

Telemedicine and Medical Technology in the University of Vaasa

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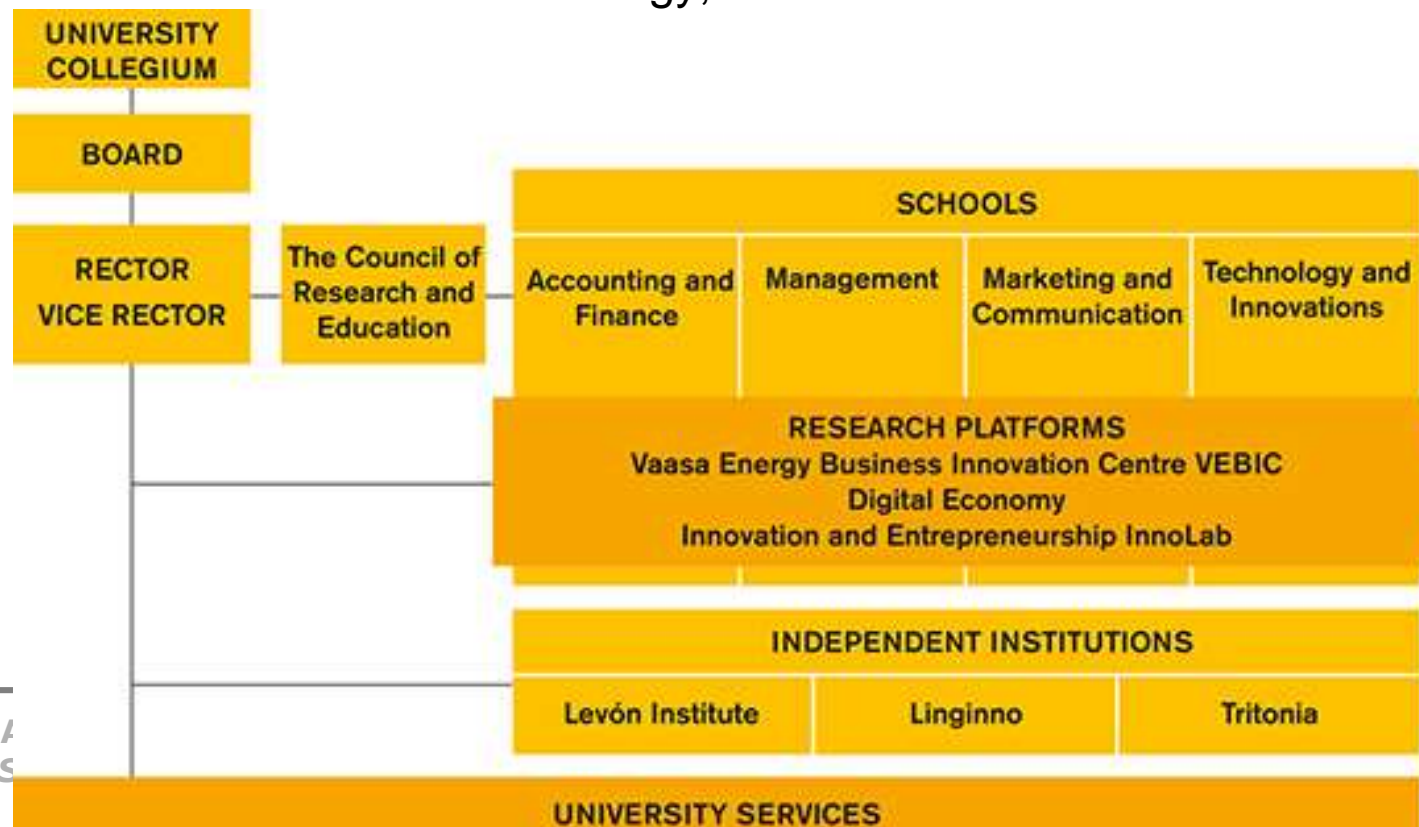
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University of Vaasa

- Homepage:

- <http://www.uva.fi/en/>
- Small university, approx. 5000 students, and about 500 teachers, researchers and administrative staff
- 4 schools, 3 research platforms, 3 independent institutions
- Scientific fields economics and technology, we do not have medical faculty



Master's Programme in Industrial Digitalisation

- **Welcome to the Master's Programme in Industrial Digitalisation!**
 - <https://www.univaasa.fi/en/education/master/wia/>
- The aim of the programme is to educate qualified Masters of Science (Technology) with a specialisation in distributed energy production information systems.
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- The programme has been carefully designed to build the students' knowledge in the area of information, communication, and computing technologies focusing on the digitalisation tools in energy and related systems, and also to teach students the skills of scientific research. Thus it qualifies the students for a career in the industry as well as in the academia.



UVA, medical technology projects, Current

- **Nordic Telemedicine Center NTC**
- Nordic Telemedicine Center is aiming to highlight the advantage of telemedicine solutions and technologies in everyday life. The goal of this competence centre is to enlighten the citizens about the available technological solutions for their everyday needs, to help the technology providers to reach the relevant target audiences better and to provide learning material and trainings on these technologies.
 - <https://www.nordictelemedicinecenter.eu/index.php/en/>
- UVA studying in this project eg:
 - Monitoring elderly people with sensor networks
 - Using drone to create ad-hoc sensor network to the accident site
 - Sustainability of the NTC and business models



Nordic Telemedicine Center NTC, “Drone case”

- The main targets for the drone in the NTC project are:
 - Test the using of camera on the air
 - ☞ Real time video link from air to network
 - ☞ Using of GPS positioning information in person search
 - ☞ GPS information in flight planning
 - The defined cases for this topic are:
 - ☞ Emergency searching of missed persons
 - ☞ Delivering of urgent packets (drugs, emergency packages etc)
- For this topic, the drone has been equipped with steerable camera and ability to take live video stream and radio link for sending data to ground network.
- Other target for the drone is to test node deploying ability and data collection in the emergency and/or searching case.
 - Testing of automatic, GPS based node network deploying.
 - Testing of datalink between node fleet and drone gateway.



Nordic Telemedicine Center NTC, "Drone case"

- Generating AD hoc sensor network to the accident site with drone
- Test area: Kauhava city, Kleemola, unplugged rape field
- Condition: +18C, RH 50%, wind estimated 4m/s south

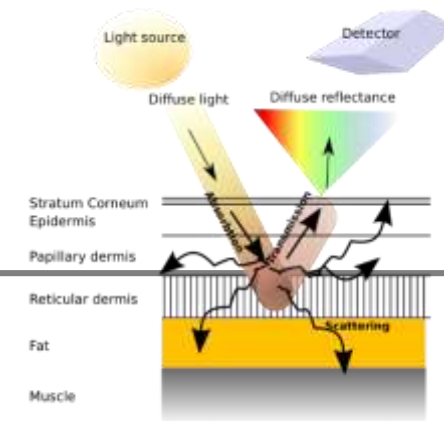
| Test 1: | Test 2: | Test 3: | Test 4: | Test 5: | Test 6: |
|---|---|---|---|--|--|
| Basic flight task with GPS steered, with manual start up and landing. | Flight task "follow the person". Manual flight with GPS stabilization. | Flight task "find the GPS positioned person". | Drop the nodes with GPS tracking | Drop the nodes in fixed place, try to find variation of landing position | Maximum height dropping test. |
| Works well, GPS had to be calibrated because of new location. | Works well. In flight height 50m some hundreds of meters can be followed by rotating the camera and zoom. | Works well. | Works well. No destroyed nodes. Only one node opened during the hit. All nodes has been found in the coordinates. | Nodes has been landed in the circle diameter 4-5m when dropping height is 20m. Wind about 4m/s | Nodes has been dropped in 150m height. No damages. |
| Camera control tested and test pictures has been taken. | Flight height about 30m | Flight height about 30m | Flight height about 20m | Flight height about 20m | Flight height about 150m |
| Flight height about 30m | Landing ok. | Landing in slide because of wind. ok. | Landing ok. | Landing ok. | Landing ok. |



UVA, medical technology projects, Current

- **Spectral Imaging of Complex Surface Tomographies (SICSURFIS)**
- Medical imaging helps to see better and deeper than it is possible with bare visual inspection. Imaging methods based on visible and near infrared (vis-NIR) light are noninvasive and are thus under active research.
- The reconstruction of the structure of optically active media based on refraction and light scattering is mathematically illposed and non-linear problem by nature.
- When spectral imaging is done from closer range, surface topography and also tomography starts to affect the spectral quality and homogeneity of images. Good examples of such surfaces are human skin and tooth.

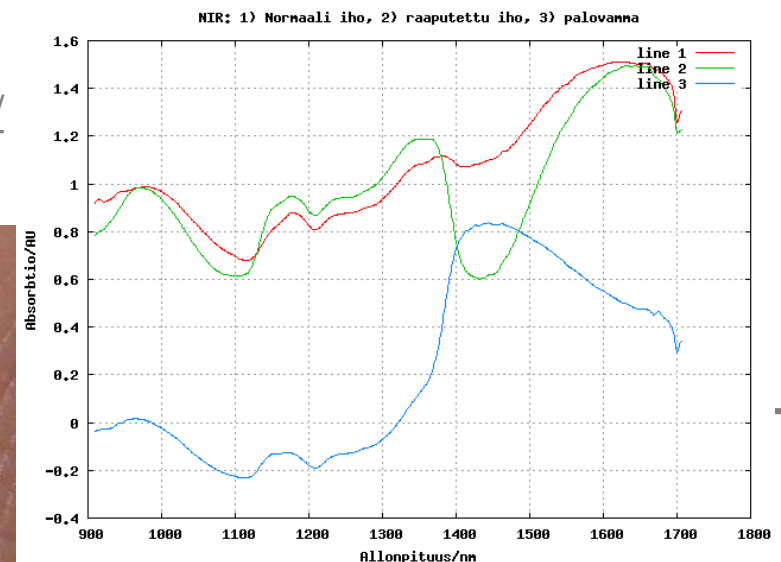
➤ <https://www.univaasa.fi/fi/news/raddress/>



UVA, medical technology projects, "Past"

■ IMU, Project for Diagnosing and Monitoring Skin Disorders

- **IMU** was a project, which applied modern digital imaging and computing methods for diagnosis and monitoring of skin disorders. The main themes include:
 - Automatic control of imaging parameters in order to produce images that are easy to compare
 - Automatic geometrical measurements from the images: extend of skin disorders
 - Color measurements for automatic skin status classification
 - Spectroscopical imaging and analysis for classification and visualisation
 - Automatic reporting of skin recovery
 - <http://lipas.uwasa.fi/~TAU/memos/IMU/>
 - <http://lipas.uwasa.fi/~pvs/imu/>



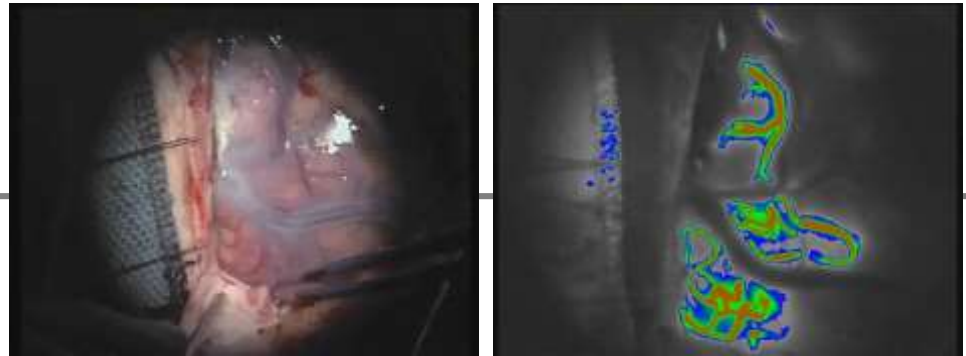
UVA, medical technology projects

- **NIRSskin A Database of Near-Infrared Spectra of Human Skin**
 - **NIRSskin** is a database containing near-infrared spectrum of the skin of volunteer persons. The database is intended to be used as a reference when developing skin imaging methods based on near-infrared technology. The responsible and maintainer of the database is the AUTO group of the Department of Electrical Engineering and Automation of the University of Vaasa.
 - <http://lipas.uvasa.fi/~TAU/memos/NIRSskin/>
- **MirriNIRri Veterinary Applications of Near-InfraRed Endoscopy**
 - **MirriNIRri** (kitten NIR) is a joint project applying Near-InfraRed (NIR) spectroscopy in veterinary endoscopy. The participants are the AUTO group of the Department of Electrical Engineering and Automation of the University of Vaasa and Prof. Spillman's group of the Small Animal Clinic of the Veterinary Faculty of the University of Helsinki.
 - <http://lipas.uvasa.fi/~TAU/memos/MirriNIRri/>



UVA, medical technology projects

- **VisioNIRS Visual and Near-InfraRed Real-Time Optical Tomography**
 - **VisioNIRS** is a draft name for a proposed joint project applying visual and Near-InfraRed (NIR) spectroscopy in optical tomography imaging. The main project coordinator is the AUTO group of the Department of Electrical Engineering and Automation of the University of Vaasa.
 - <http://lipas.uvasa.fi/~TAU/memos/VisioNIRS/>
- **Värisuonet Color veins**
 - **Color veins** page contains links to methods trying to make blood veins more illustrative e.g. by coloring grey tone angiograms got by indocyanine green contrast agent.
 - <http://lipas.uvasa.fi/~TAU/memos/varisuonet/>



UVA, medical technology projects

- **MakeUpMeter: A Color Meter for e.g. Skin Applications**
 - **MakeUpMeter** is planned for skin and other similar surface hue measurements for recreational, artistic, cosmetic, medical (dermatology) etc applications. In addition it is used as a demonstration (motivation) device for engineering studies.
 - <http://lipas.uwasa.fi/~TAU/memos/MakeUpMeter/>
- **Kiillekeiju**, project applying optics, lasers and image processing for dental care and dentistry.
 - <http://lipas.uwasa.fi/~TAU/memos/KiilleKeiju/>



UVA, medical technology projects

- **AUTOsydan AUTOheart AUTOMation and heart research**

- **AUTOheart** page contains links to heart imaging and similar pages especially to contrast agents used in imaging, in particular to papers using near-infrared fluorescent indocyanine green.
- <http://lipas.uwasa.fi/~TAU/memos/AUTOsydan/>

- **AUTOaivo AUTObrain AUTOMation and brain research**

- **AUTObrain** page contains links to brain imaging and similar pages especially to contrast agents used in imaging, in particular to papers using near-infrared fluorescent indocyanine green.
- This page is produced in FIELD NIRce project which is a subproject of Bothnia-Atlantica.
- <http://lipas.uwasa.fi/~TAU/memos/AUTOaivo/>



UVA, medical technology projects

- **MedVaasa Workshop on Medical (Computer) Engineering**

- **MedVaasa** is an umbrella concept for those activities of University of Vaasa that are related to medical engineering.
This webpage is the noteboard, notepad, link list etc of the MedVaasa2010 workshop. The page is maintained by the AUTO group (AUTO pojjaat / boyz) of the Department of Electrical Engineering and Automation of the University of Vaasa.
- <http://lipas.uvasa.fi/~TAU/memos/MedVaasa2010/>



UVA, medical technology courses

- **AUTO3140 LÄÄKETIETEELLINEN TIETOTEKNIikka /MEDICAL INFORMATICS**
- Information systems are more and more important also in healthcare sector.

Are you interested in medical information processing systems? Then the course AUTO3140 Medical informatics is just for you! It will give you an introduction to modern computer aided medical information processing and methods. The course is recommended for everyone interested in medical information processing. The course is especially useful as part of computing and signal processing studies as well for engineers and medical personnel.

The course covers the main medical information methods and regulations.

The course is planned to suit as well both **nerds** and **non-nerds**. The most important aid to pass the course is **plain motivation**.

➤ <http://lipas.uwasa.fi/~TAU/AUTO3140/>



UVA, medical technology courses

- **AUTO3050 FYSIOLOGINEN PSYKOLOGIA /PHYSIOLOGICAL PSYCHOLOGY**
- Are you interested in human-machine interface?
Now you can teach yourself how the human (animal) brains and neural networks are constructed and functioning. The course is recommended for everyone and especially for those who are interested in man-machine interfaces, computing, computers, measurements, physics, signal processing, control, mechatronics, neural networks (soft computing), pedagogics etc. The course is especially useful as providing background information for the study of artificial neural networks and artificial intelligence.
 - <http://lipas.uwasa.fi/~TAU/AUTO3050/>



UVA, medical technology courses

- **AUTO3130 LÄÄKETIETEELLINEN KUVANTAMINEN / MEDICAL IMAGING**

- Are you interested in medical instruments and signal processing systems?

Then the course AUTO3130 Medical imaging is just for you!

It will give you an introduction to modern computer aided medical imaging technology and methods. The course is recommended for everyone interested in automation and measurements. The course is especially useful as part of signal processing, computing and physics studies for engineers.

The course covers the main medical imaging methods especially from the image processing point of view.

➤ <http://lipas.uwasa.fi/~TAU/AUTO3130/>



UVA, medical technology courses

- **AUTO3180 PROTEIN PHYSICS**

- Are you interested in materials engineering and physics and their application to biotechnology and bioinformatics?
- The course AUTO3180 Protein physics is planned to deal with that area in common biology, medicine, computing and material engineering possibly as a joint course.
- It will give you an introduction to the key biochemical molecule group called peptides, proteins, and enzymes. The course is recommended for everyone interested in biotechnology and bioinformatics. The course is especially useful as part of MedicalCT module studies. Protein modeling is a good example of computational and simulation approach in solving scientific problems of natural sciences.
- The course contains basic knowledge of proteins and their modeling and basic chemistry and physics of proteins and an introduction to bioinformatics.

➤ <http://lipas.uwasa.fi/~TAU/AUTO3180/>



UVA, some publications (not updated)

- Mantere, Timo (2013). Identifying spectra content by generating similar simulated spectra from known samples using genetic algorithms. In *NIR 2013 - 16th International Conference on Near Infrared Spectroscopy* 2-7 June 2013, la Grande-Motte, France, pages 699-703.
- Mantere, T., P. Välisuo, J.T. Alander (2010) Testing NIR based skin spectra analyzer system and software with the simulated data generated by genetic algorithm. In *Near Infrared Spectroscopy: Proceedings of the 14th International Conference*, Sirinapa Saranwong, Sumaporn Kasemsumran, Warunee Thanapase and Phil Williams (eds.), IM Publications LLP 2010 West sussex, UK, ISBN: 978-1-906715-03-8, pp. 621-626.
- Välisuo, Petri, Timo Mantere and Jarmo Alander (2009). Solving optical skin simulation model parameters using genetic algorithm. In *Proceedings of the 2nd International Conference on BioMedical Engineering and Informatics (BMEI'09)*, 17-19 October 2009, Tianjin, China, pages 376-380.
- Mantere, Timo (2009). Co-evolutionary software development and testing revisited. In *Proc. of NEXT 2009 - The Sixth International New Exploratory Technologies Conference*, 12-14 October 2009, Shanghai, China, pages 306-315.
- Autere, Antti, Timo Mantere and Jarmo T. Alander (2009). Numerical differentiation of noisy NIR spectra. In *NIR-2009 Breaking the Dawn – Abstract Book - The 14th Int. Conf. on Near Infrared Spectroscopy*, 7-16 November 2009, Bangkok, Thailand. P-170, page 280.
- Mantere, Timo, Petri Välisuo and Jarmo T. Alander (2009). Testing NIR based skin spectra analyzer system and software with the simulated data generated by genetic algorithm. In *NIR-2009 Breaking the Dawn – Abstract Book - The 14th Int. Conf. on Near Infrared Spectroscopy*, 7-16 November 2009, Bangkok, Thailand. 046-O, page 51.
- Mantere, Timo (2007). Testing NIR data processing system with genetic algorithms. In *Proceedings of the 13th Int. Conf. on Near Infrared Spectroscopy (13th ICNIRS)*, Umeå-Vasa (Sweden-Finland), 15–21 Jun. 2007. USB FlashDrive abstract proceedings.



UVA, medical technology

- Jarmo Alander:

- https://taika.uwasa.fi/crisyp/disp/8_/fi/cr_asiatunt/edi/tab/fet?stack=push&cro=2733241718331819182921262836391719242721232118233622232528292838273822292738393739283727351836321717&verkko=1

- Petri Välisuo:

- https://taika.uwasa.fi/crisyp/disp/5_/fi/cr_asiatunt/edi/tab/fet?stack=push&cro=2733241718331819182921262836391719242721232118233622232528292838273822292738393739283727351836321717&verkko=1

- Birgitta Martinkauppi

- https://taika.uwasa.fi/crisyp/disp/11_/fi/cr_asiatunt/edi/tab/fet?stack=push&cro=2733241718331819182921262836391719242721232118233622232528292838273822292738393739283727351836321717&verkko=1

- Vladimir Bochko

- https://taika.uwasa.fi/crisyp/disp/15_/fi/cr_asiatunt/edi/tab/fet?stack=push&cro=2733241718331819182921262836391719242721232118233622232528292838273822292738393739283727351836321717&verkko=1

- Janne Koljonen:

- https://taika.uwasa.fi/crisyp/disp/18_/fi/cr_asiatunt/edi/tab/fet?stack=push&cro=2733241718331819182921262836391719242721232118233622232528292838273822292738393739283727351836321717&verkko=1



QUESTIONS?

