



# Can technological solutions support user experience, learning, and operation outcome in robotic surgery?

ERF2016 Session

Image Guided Robotic Surgery and Interventions

Ljubljana, Slovenia, 23 March 2016

Iina Aaltonen

VTT Technical Research Centre of Finland Ltd

## Research project WoBLE — Work Based Learning

- WoBLE examines means for developing work practices
  - With robotic systems, surgical activity requires not only medical knowledge but also the use of cutting-edge technology
- Surgeons' interviews and observations in the operating theatre
- Future workshop
  - Evaluation of technologies while also considering task requirements and context of work
  - Participants: five surgeons, who regularly perform prostatectomies using da Vinci S Surgical System

# Research project WoBLE — Work Based Learning

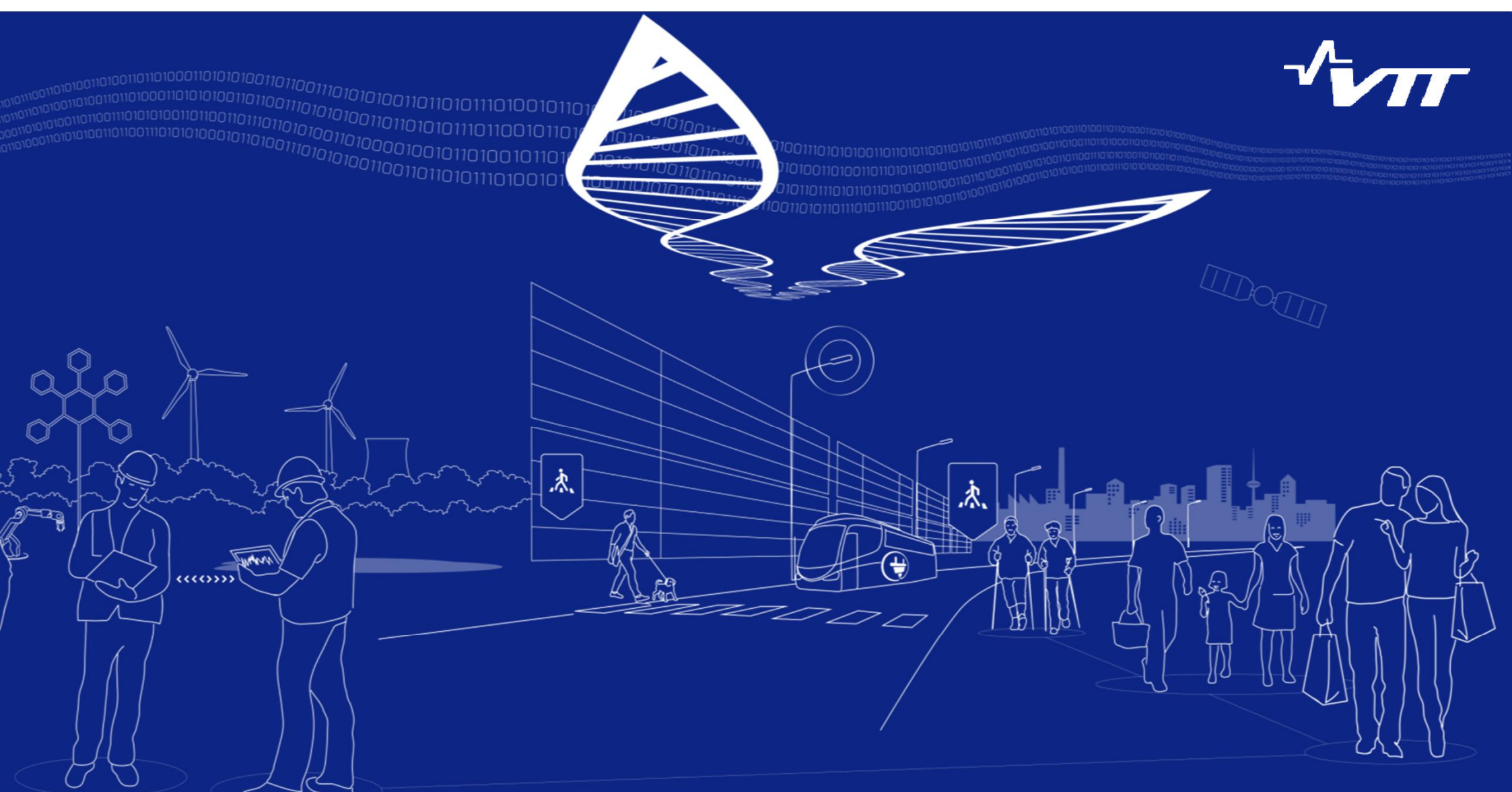
- Workshop research question:

*What are the most promising new technologies in robot surgery from the viewpoint of improving ...*

- 1) *operation outcomes?*
- 2) *user experience?*
- 3) *teaching and learning hands-on robot surgery?*

# Selection of 26 technologies for the workshop

- Literature review on state-of-the-art in robotic surgery
  - Single-port operation, haptic feedback, telestration, augmented CT/MRI overlay, virtual no-go zones, eye tracking, ...
  
- Ideas deduced from the observations and interviews, for technologies supporting...
  - Visibility and landscape
  - Status display
  - Identification of tissues
  - Specific to prostatectomy
  - Surgeons with less experience and in their learning phase



# Workshop results

## Workshop results

- Each technology was presented with slides and/or videos
- Surgeons rated the 26 technologies using a 4-item scale
- 7 technologies were rated useless (by one or more surgeons)
- 19 technologies would be instantly taken into use ( " )
- 16 technologies were discussed in more detail

# Technologies for improving ... — operation outcome?

- The starting point is to see where the cancer cells are (in prostatectomy operations)
  - E.g., fluorescence tagging
  - All other functionalities and technologies are secondary!
  
- Secondly, technology could improve
  - Tissue identification, nerve sparing
  - Operating speed, less complications
  - Safety
  - Less invasive
  
- These technologies have been suggested in literature
  - E.g., CT/MRI image overlay

# Technologies for improving ... — user experience?

- Lack of haptic feedback is most significant
  
- Visual representation has to compensate
  - **Visibility, illumination**, landscape
  - Camera view, changing the view
    - A head-mounted display would have pros and cons regarding ergonomics
  
- Many of the visibility issues can be solved by defogging the lens and adaptive illumination



# Technologies for improving ... — teaching and learning hands-on robot surgery?

- Support for
  - identifying and separating tissues by visualization methods
  - learning from observing
  - leaving landmarks on image
  
- Communal aspect for data logging and comparison data
  - "SportsTracker" for surgery

# A holistic, system-level view to robotic surgery

- User interaction in robotic surgery has been mostly studied from two perspectives
  1. Development of technology
  2. Surgical outcome
  
- In our opinion, the current dialogue lacks input from **human factors experts** focusing on human-robot interaction and the **context of work**
  
- Combining knowledge of the **needs of the users** and the state-of-the-art **technology of any domain** could benefit the robotic community and the continuous development of better surgical systems.



# TECHNOLOGY «» FOR BUSINESS

Contact:  
Iina Aaltonen  
[iina.aaltonen@vtt.fi](mailto:iina.aaltonen@vtt.fi)