RESKILL - Building systems for reskilling of operators and instructors

Aida Nordman & Jonas Lundberg, Linköpings universitet
RESKILL A:
Operatörens förståelse av det autonoma systemet

RESKILL I:
Instruktörens förståelse av operatören

Självförklarande automation

Visuellt beteende

Hur ska vi kompetenssäkra operatörer för framtidens digitaliserade arbetsmiljö med ny automation och autonoma system?

Lotsning

Multiple remote tower
Röd och blå flygplats
RESKILL-I

- Create tools that can aid instruction process
  - Which visual task solution strategies do trainees use?
  - How do these strategies compare to the ”guidelines”?
  - Can we find unforeseen strategies likely to lead to a given safety incident?
  - Compare task solution strategies for different groups of participants
    - Novices versus experienced ATCOs
    - Day time versus night time

Data sources:
- Eye-tracking data
- Traffic data from simulators
- Sensor data
Convert eye-tracking data to meaningful information

- Typical, approaches existing in eye-tracking systems

**Heatmaps**: amount of attention in each area

**Gaze plot**: time sequence of looking

**Limitations**:
- Aggregation in space and time
- Visual clutter

Few minutes of recording data (eg. 60Hz rate) results in over a million fixations
Reskill-I: our approach

- Data mining -- to find patterns
- Visualization -- to convey discovered knowledge to the user
- Interactivity -- user guided knowledge discovery process

Pattern example:

```
strip-table → runway → radar
<2s      >10s      <2s
```
Interactive visual sequence mining

1. Find areas-of-interest (AoI)

2. Create sequences

3. Use sequence mining algorithms to find patterns

- Manual approach
  -- MAPPS software
- Automated approach

User driven
Transparent-box model
Reskill-I: research

Automatic identification of AoIs
Eye-gaze sequences → sequences of AoIs

Research strategies for increased user interaction
Active steering of computation in progress
Constraints

Instructor support tools

Research AOI extraction

Research AOI pattern extraction

Research functionality & interface

Evaluation

Interactive visualizations
Pre-processing capabilities

Automatic identification of AoIs
Eye-gaze sequences → sequences of AoIs

Research strategies for increased user interaction
Active steering of computation in progress
Constraints

Instructor support tools

Research AOI extraction

Research AOI pattern extraction

Research functionality & interface

Evaluation

Interactive visualizations
Pre-processing capabilities
Research publications


• Muthumanickam P., Vrotsou K., Nordman A., Johansson J., Cooper M. “Identification of Dynamic Areas of Interest in Long Duration Eye Tracking Data Set”. Submitted to Eurographics Conference on Visualization (EuroVis), 2018.