Context Understanding for Medico–Social Assistance with an Interactive Robot

W. BEN GHEZALA, G. BREDA, L. DEVIGNE, P. BAZIN, N. BEAUMATIN

Altran Research, France

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Introduction

Robotic systems for medico-social monitoring

Situation understanding

Main results

Conclusion
Introduction: General context

Ageing of the population and chronic diseases:
- Increase of population aged 80+:
  - 69 Millions in 2000
  - 379 Millions in 2050
  - 70% of deaths are attributable to chronic diseases

Service robotics:
- a growing sector

Robotics as a support to health systems transformations by:
- Enhancing the efficiency and accessibility of health care services
Introduction : Objective

The needs of patients and elderly people under medico-social monitoring are:
- Well-being and safety
- Motivation and feedback
- Communication with caregivers and doctors

Our objective is to assess the technical feasibility of intelligent medical monitoring of people using a Human Friendly robot:
- Follow the situations over time (activities, emotions,..)
- Detect situations requiring the intervention of the caregiver and / or doctor
- Contact their medical and social environment
- Be integrated into robotic systems (Nao, others ..)
Introduction

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Main results

Conclusion
Assistive robotics

Ambition:

- Understand all the **dimensions of situations**
- Provide reasoning inspired of **cognitive science** (similar to that of humans)
- **Adapt behavior** of the robot, according to situations of people
- **Integrate** our system on various robotic systems
Introduction

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Main results

Conclusion
General Approach

Perception/Recognition

- Recognition functions related to wearable sensors
- Recognition functions related to environment sensors
- Recognition functions related to robot sensors

Situation understanding

Action

- Suggest a questionnaire or not

Wearable Sensors (person)

Environment Sensors

Robot Sensors
Situation understanding: State machine

- **Solitary mode**
  - Non human activities
  - Sensor of motion and noise
  - Predefined moment by the person

- **Activity Detection**
  - Update the statistical variable

- **Hours/days**
  - Day and empty calendar

- **Face Recognition**
  - Recognized person

- **Data sensor**
  - High activity
  - High temperature
  - Prone position

- **Questionnaire**
  - Questionnaire is already passed
  - Yes
  - No

- **Questionnaire is requested**
  - Predefined moment by the person
  - Questionnaire requested by person

- **Update the statistical variable**

- **Statistic**
  - Positive answer
  - Negative answer
Introduction

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Main results

Conclusion
Implementation of situation understanding on NAO using Chorégraphe

- Preferred moment
- Detected movement
- Calendar
- Person recognition: Face + Speech
- Questionnaire
- Statistic
Main results

<table>
<thead>
<tr>
<th>Application Launch</th>
<th>% success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demande du patient</td>
<td>100%</td>
</tr>
<tr>
<td>Détection d'activité</td>
<td>100%</td>
</tr>
<tr>
<td>Moment préféré</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Person recognition</th>
<th>% Success</th>
<th>Response time</th>
<th>% success with improvement</th>
<th>Response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without glasses</td>
<td>60%</td>
<td>RT&lt;3s</td>
<td>82%</td>
<td>RT&lt;3s</td>
</tr>
<tr>
<td>With glasses</td>
<td>61%</td>
<td>RT&lt;3s</td>
<td>75%</td>
<td>6s&gt;RT&gt;3s</td>
</tr>
<tr>
<td>Different background</td>
<td>43%</td>
<td>RT&lt;3s</td>
<td>60,2%</td>
<td>6s&gt;RT&gt;3s</td>
</tr>
<tr>
<td>Age and gender</td>
<td>70%</td>
<td>RT&gt;10s</td>
<td>90%</td>
<td>RT&gt;10s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calendar trial</th>
<th>% success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>100%</td>
</tr>
<tr>
<td>Add</td>
<td>100%</td>
</tr>
<tr>
<td>Erase</td>
<td>100%</td>
</tr>
<tr>
<td>Preference</td>
<td>100%</td>
</tr>
<tr>
<td>Impossibility</td>
<td>100%</td>
</tr>
</tbody>
</table>

- Global system’s precision: **76.8%**
- An improvement compared to the existing: **18.2%**.
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Situation understanding

Main results

Conclusion
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- Smart medico-social monitoring is a rich scientific research topic because it addresses several axes starting from IT to health through robotics.

- This first work has allowed us to develop a first proof-of-concept and to increase efficiency of recognition functions.

- Further research is needed to increase our system’s response time with effectiveness convergent to 100%.

- Future research will address situation understanding using web semantic techniques.
Thank you for your attention

INNOVATION MAKERS

Contact: walid.benghezala@altran.com
         Gabriele.breda@altran.com