Artificial Intelligence and Assistive Medicine

AI&AM /NETMED 2014 workshop in ECAI2014

Introduction

Constantine D. Spyropoulos
NCSR ‘DEMOKRITOS’
Athens - Greece
Outline

- Healthcare Worldwide Data
- Telemedicine Framework
- AI and Medical Systems
- Internet, Broadband and Sensor Networks
- AI and Assistive Medicine
- Healthcare Global Challenge
- Social & Technical Issues to be Concerned
Aging Earth Population (J. Baras, NETMED 2013)

Today...

- 34 million elders in U.S.
- 550 million worldwide
- 5 U.S. workers to 1 retiree
- 3 Japan workers to 1 retiree

By 2025...

- 74 million elders in U.S.
- 1.2 billion worldwide
- 3 U.S. workers to 1 retiree
- 2 Japan workers to 1 retiree
- Other facts...
- 80+ years old is fastest growing
- “old old” are 2 women : 1 man

Note: Data for the years 2000 to 2050 are middle-series projections of the population.
Reference population: These data refer to the resident population.
Source: U.S. Census Bureau, Decennial Census Data and Population Projections.
Healthcare Worldwide Data (2/2)

Typical Lifetime Health Care Costs (J. Baras, NETMED 2013)

- Last 10 yrs of life 70 – 80 % of medical costs is needed

Wanted

- A ‘flatter’ lifetime costs curve
- A curve with substantially lower ‘integral’ (total costs)
Telemedicine Framework

The use of information and communication technologies (ICTs) for the delivery of clinical care

- store and forward
- real time medical consultation from Experts
- Service usually recommended by Physicians
AI and Medical Systems

- AI-based clinical decision making
- Medical knowledge engineering
- Knowledge-based systems in medical education and research
- Intelligent medical information systems
Internet, Broadband and Sensor Networks

Internet and Broadband wired or Wireless Sensor Networks Benefits to Society Health Care

- Essential for preventive maintenance based healthcare
- Essential for health care in rural and underdeveloped areas (almost 95% of the current earth’s population and locations)
- Expected much higher quality health care at lower cost and much wider availability
- Patient education and awareness
- Physician, nurse and hospital training
AI and Assistive Medicine

Measurements using non-specialized hardware

- Exploiting Unobtrusiveness
- Long-term monitoring
- Real time analysis and early detection
- Elderly people / social awareness
- Caregivers support
Healthcare Global Challenge
(J. Baras, NETMED 2013)

Increase the quality of care & of life... for twice the number of seniors... while reducing healthcare costs

◆ Current healthcare system is optimized for treating disease; innovation is clinic-and-pharmaceutical centric
◆ Have to invent system optimized for wellness (prevention, early detection, compliance, caregiver support)
◆ Must put technologies into everyday lives of people; must put the home, consumer, & informal caregivers “in the loop” and offload formal institutions when appropriate

It will take decades to achieve, but must start R&D (research & debate) now if we ever hope to get there
Social & Technical Issues to be Discussed

Societal problem:

Users may be afraid that their everyday life as well as their health records is publicly "exposed"

Issues:

- People Trust of Technology
- Privacy
- Social Awareness
- Interoperability
- Integration with legacy systems
### Workshop Schedule (1/3)

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>8.30 - 9.00</td>
<td>Registration</td>
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<tr>
<td>9.00 - 9.30</td>
<td><strong>Introduction</strong>&lt;br&gt;&lt;em&gt;Dr. Constantine D. Spyropoulos - NCSR &quot;Demokritos&quot;, Greece&lt;br&gt;Prof. Aldo Franco Dragoni - Università Politecnica delle Marche&lt;/em&gt;</td>
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### Session 1: e-Health & m-Health

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<tr>
<td>9.30-10.00</td>
<td>The impact of different training sets on medical documents classification&lt;br&gt;&lt;em&gt;Roberto Gatta, Mauro Vallati, Berardino De Bari, Mahmut Ozsahin&lt;/em&gt;</td>
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<tr>
<td>10.00-10.30</td>
<td>MAGPIE: an agent platform for the development of mobile applications for pervasive healthcare&lt;br&gt;&lt;em&gt;Albert Brugués, Stefano Bromuri, Josep Pegueroles Valles, Michael Ignaz Schumacher&lt;/em&gt;</td>
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<td>10.30-11.00</td>
<td>Coffee Break</td>
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### Session 2: Ambient Assisted Living

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<td>11.00 - 11.30</td>
<td>The DemaWare service-oriented AAL platform for people with dementia&lt;br&gt;&lt;em&gt;Thanos Stavropoulos, George Meditskos, Efstratios Kontopoulos, Ioannis Kompatsiaris&lt;/em&gt;</td>
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# Workshop Schedule (2/3)

<table>
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<tr>
<th>Time</th>
<th>Session</th>
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| 11.30-12.00 | **Using 3D simulators for the ambient assisted living**  
Paolo Sernani, Andrea Claudi, Paolo Calvaresi, Daniele Accattoli, Roberto Tofani, Aldo Franco Dragoni |
| 12.00 - 12.30 | **Today, how was your ability to move about?**  
Felip Miralles, Eloisa Vargiu, Eloi Casals, José Alejandro Cordero, Stefan Dauwalder |
| 12.30 - 14.00 | Lunch Break                                                                                                     |

**Session 3: AI & Medical Diagnosis I**

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<th>Time</th>
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| 14.00-14.30 | **SVM-based CBIR of breast masses on mammograms**  
Lazaros Tsochatzidis, Konstantinos Zagoris, Michalis Savelonas, Ioannis Pratikakis |
| 14.30-15.00 | **Employing time-series forecasting to historical medical data: an application towards early prognosis within elderly health monitoring environments**  
Antonis Billis, Panagiotis Bamidis |
| 15.00-15.30 | **Medical diagnostics based on combination of sensor and user-provided data**  
Maja Somrak, Anton Gradišek, Mitja Luštrek, Ana Mlinar, Miha Sok, Matjaž Gams |
| 15.30-16.00 | Coffee Break                                                                                                    |
### Session 4: AI & Medical Diagnosis II

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<th>Topic</th>
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| 16.00-16.30 | Realtime depression estimation using mid-term audio features  
Theodoros Giannakopoulos, Christos Smailis, Stavros Perantonis, Constantine D. Spyropoulos |
| 16.30-17.00 | Final Discussion                                                      |