Experimental restaurant of the Future

-Towards Intelligent Social Interaction Detection

Pr. Dr. Florence Sèdes
IRIT, Institut de Recherche en Informatique
Toulouse (France)
Information Systems and Database modelling
Security – Privacy
Videosurveillance
(CCTV – Forensic)
Food in the Age of Data: new challenge(s) for computer science?
Let’s analyse the context...

« ... new generation of scientific equipment »
... scientific equipment?
... new generation!
Let’s analyse the context...

« ... restaurant of the future »

... future ?  =>  computer!

... what about restaurant and computers?
Recent trends in "computerised restau"?

- Food in the Age of Data...
- Computational Gastronomy...
- Computer-Curated Culinary Creations...
Recent trends

- 8th Computer Cooking Contest – Sept. 2015
  An event of ICCBR 2015, Frankfurt, Germany
  [http://www.computercookingcontest.net/](http://www.computercookingcontest.net/)

- 7th International Workshop on Cooking and Eating Activities (CEA2015) (Japanese)
  In conjunction with IEEE Int. Conf. on Multimedia and Expo Torino, July 3, 2015
Recent trends

- Computational Gastronomy - Food in the Age of Data
  Royal Society International Scientific Seminar

- Network analysis and data mining in food science: the emergence of computational gastronomy
  Sebastien Ahnert, Cambridge
Flavor Pairing in Medieval European Cuisine: A Study in Cooking with Dirty Data

*International Joint Conference on Artificial Intelligence Workshops*, Beijing, China, August 2013.

Dr. Kush Varshney, Professor Lav Varshney have authored a series of papers on the theme of computational gastronomy.

Co-authored with Jun Wang, also at IBM, and Daniel Myers at Medieval Cookery.
Recent trends

- IBM's Chef Watson
Social media

- Resolving local cuisines for tourists with multi-source social media contents


Multi-source social media content Location-aware aggregation Local cuisines
Speech + food
...sub-title?

which contribution for the data science to the study of food behaviour and nutrition?

... and vice-versa?...
The context
How to «interpret» Man-Man Interaction?

- Advanced applications that embody *more and more intelligence* as such, aim to provide *innovative services* and enable *various* users to be *better known, informed* and make *safer* and 'smarter' use of *devices*.
- Spatial and temporal features
- Context
- Culture
- Personality, individual features (explicit / implicit)
Internet of Things (IoT): Intelligent devices (interconnected, smart)

- Wireless communications
- Embedded devices
- Sensing technologies
- Bluetooth detection (travel time, estimation)
- Video detection (non intrusive?)

« things are talking to things »
Data vs. data

**data** noun plural but singular or plural in construction, often attributive

- facts or information used usually to calculate, analyze, or plan something
- information that is produced or stored by a computer

**Full Definition of DATA**

1 : factual information (as measurements or statistics) used as a basis for reasoning, discussion, or calculation <the data is plentiful and easily available — H. A. Gleason, Jr.> <comprehensive data on economic growth have been published — N. H. Jacoby>

2 : information output by a sensing device or organ that includes both useful and irrelevant or redundant information and must be processed to be meaningful

3 : information in numerical form that can be digitally transmitted or processed
# Internet of Things (IoT):
*Intelligent devices (interconnected, smart)*

- Irrelevant, incomplete, uncertain, noisy, redundant,...
- **Big Data**
  - Variety
  - Volume
  - Veracity
  - Velocity
- Privacy
Social Interaction Detection
Social Interaction Detection

©Social signal processing: Survey of an emerging domain
Alessandro Vinciarelli, Maja Pantic, Hervé Bourlard
Social Interaction Detection

Postural congruence.
Social Interaction Detection

Space and seating

Conversation  Cooperation  Co-action  Competition
Social Interaction Detection

Speech, stop words, silence, onomatopeias,...
# Social Interaction Detection

## Table 1

The table shows the behavioural cues associated to some of the most important social behaviours as well as the technologies involved in their automatic detection.

<table>
<thead>
<tr>
<th>Social cues</th>
<th>Example social behaviours</th>
<th>Tech</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emotion</td>
<td>Personality</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Height</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Attractiveness</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Body shape</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Gesture and posture</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Hand gestures</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Posture</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Walking</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Face and eyes behaviour</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Facial expressions</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Gaze behaviour</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Focus of attention</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Vocal behaviour</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Procedy</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Turn taking</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Vocal outbursts</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Silence</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Space and environment</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Distance</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Seating arrangement</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

©Social signal processing: Survey of an emerging domain
Alessandro Vinciarelli, Maja Pantic, Hervé Bourlard
Machine analysis of social signals and behaviours: a general scheme.
Social Interaction Detection...

... but analysis, interpretation, recognition, identification?

⇒ Robustness?
⇒ How to «replay» experiment?
Video Metadata

- Focus sur la caméra
- Position
- Hauteur
- Pan/Tilt/Zoom/Roll
- Taille du capteur
- Focale
- Résolution
- Densité de pixels
- Compression
- Timestamp

Indoor/Outdoor

Système de référence

θ

α

Dmin

Dmax

>30 pixels/mètre

>100 pixels/mètre

>400 pixels/mètre

>800 pixels/mètre

Inspection
Identification
Reconnaissance
Détection

AB-123-AB
Towards Intelligent Social Interaction Detection...

- How analysing, mining, eliciting data, crowdsourcing, video, social networks, etc. can help us to observe new insights on our fooding habits and choices?

- « In vivo » capture and observation...
- ... for an intelligent social interaction detection and analysis!

=> no predefined scenario
Towards Intelligent Social Interaction Detection...

- Context

- Social issues

- Behaviour patterns (and counterexamples*)

- Indexes: - sentiment / emotion / ...  
  - distance / seats /...
  - word / silence / music / ...  
  as we consider multimodality-cross modality

* think about Droopy...
Towards intelligent social interaction detection...

What is relevant?

Big Data: Volume, Variety, Values, Veracity, ...
⇒ Storage issues / Online analysis / ...

⇒ Metadata: ex. <X; expr; time_i; time_j>
e.g. « X, smiling from this time \( t_{\text{start}} \) to this time \( t_{\text{end}} \) »
How to model it?

⇒ Metadata
e.g. « X smiling from this time $t_{\text{start}}$ to this time $t_{\text{end}}$ »
... an so?
⇒ How to prevent from misinterpretation?
⇒ Context
ITS applications

- Metadata
- Multimodality
- a platform = a social media ecosystem
- multimodal features = multilayer modeling
Not so boolean... fuzzy logic

Taking into account temporal and spatial approximation
[Sedes and Alboody, 2010]

Composite pathway: indoor-outdoor, camera changing, « hole » bridging,...
“Big data” refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyze. This definition is intentionally subjective and incorporates a moving definition of how big a dataset needs to be in order to be considered big data—i.e., we don’t define big data in terms of being larger than a certain number of terabytes (thousands of gigabytes). We assume that, as technology advances over time, the size of datasets that qualify as big data will also increase. Also note that the definition can vary by sector, depending on what kinds of software tools are commonly available and what sizes of datasets are common in a particular industry. With those caveats, big data in many sectors today will range from a few dozen terabytes to multiple petabytes (thousands of terabytes).

McKinsey Global Institute
Big Data...

=> big storage
=> big analytics
according to the context, the industry, the
custom/usage

=> the revolution of opening data...
Opening Data more and more...

Open data => Scalability / Variety

Public datasets related to :
- restaurant ranking
- product characteristics
- recipes
- statistics
- connected cookies (made in Toulouse)
User support?
ex.: mobile location tracking

https://maps.google.com/locationhistory

http://blog.chron.com/techblog/2013/10/your-iphone-knows-where-youve-been-puts-it-on-a-map/
User support:
How does location tracking work?
Main problem: Variety

“The Achile’s heel in BigData” (Michael Stonebraker, MIT)

Sensor data: incredible source(s) of data

Sensor data: positions, movement, annotations, metadata, direction...

How to integrate data coming from hundreds of sources in many different formats (or without any)?
What can help?....
Multimedia Metadata

- Metadata = data about data
- Instead of doing an **exhaustive** analysis of the content, how can I use context information (geolocation, social information, device characteristics, data popularity, freshness, image quality, rights) to extract useful knowledge?
  - Social Network
  - Video capture
  - Sensors
Metadata Standards

- Provides export interoperability profiles which constitutes the “exchange format” and minimum technical requirements that ensure that the contents exported from one system are compatible with the systems that will use the data.

- Example: ISO22311:
  - Enables interoperability between video surveillance systems
  - Defines an export format for data (video content) and metadata produced by videosurveillance systems
  - Comprises elements that concern: Video, Audio, Metadata (Static (localisation, camera identifier, etc.), Dynamic (date, time, pan, tilt, zoom, identification results, etc.), Container structure to integrate the before mentioned, Data security and integrity, Provisions for privacy.
Metadata Dictionaries

- Sensor Description
  - IEEE Device ID
  - Device Designation
  - Device Kind
  - Image Source Device Kind
  - Device manufacturer Name
  - IEEE Manufacturer ID
  - Device Model
  - Device Serial Number
  - Platform Serial Number
  - Platform Designation
  - Platform Model

- Static Data

- Time
  - Start Date Time - UTC
  - User Defined Time Stamp

- Optical
  - Focal Length
  - Sensor Size
  - Lens Aperture
  - Sensor Type Code
  - FOV-Horizontal
  - FOV-Vertical

- Security
  - Security Classification

- XML
  - XML Document Text

- Experimental metadata
  - Experimental Metadata

- Dynamic Data

- Device Location
  - Image Coordinate system
  - Device Coordinates (Lati, Longi, Alti)
  - Device Absolute Positional Accuracy
  - Device Relative Position (X, Y, Z)
  - Device Relative Positional Accuracy
  - Sensor Roll Angle
  - Angle to North
  - Obliquity Angle
  - Platform Roll, Pitch, Heading angles

- Observed Scene
  - Image Coordinate system
  - Frame Centre Coordinates (Lati, Longi, Elevation)
  - Frame Positional Accuracy
  - Corner Points 1-4 coordinates (Lati, Longi)
  - Slant Range
Metadata Dictionaries

- Event ID
- Event Start time – UTC
- Event classification dictionary
- Event classification
- Link ID (Link to another event)

- Experimental Metadata
  - Experimental Metadata

- Event Location
  - Image Coordinate system
  - Event Coordinates (Lat, Long, Alt)
  - Event Coordinates Precision
  - Sensor Reference Location (Sensor ID)

Mandatory
Recommended
Optional

Dynamic Data
Multilayer
Multilayer modelling and querying from metadata
Scene analysis as a hybrid query

- 1st layer: speech metadata
- 2nd layer: video streamline annotated facial
- 3rd layer: characters position
Crowd / Social: one more V?

Confidence => Volunteer

«user’s engagement» / «involvement»

e.g. improved patient/user engagement in health and care
Privacy

- ethic, rights, etc.
- privacy issues... no Big Brother?

Big Brother... you’re showing you!
Intelligent and smart smart materials => autonomy wearable computers (exosquelettes)

« That's one small step for (a) man, one giant leap for mankind.»
Energy: the key issue!
[IRIT, Toulouse + RMC, Kingston, Ontario]
... towards a new generation of scientific equipment?

such a platform must be seen as a social media ecosystem
...a social media ecosystem

Veni, vidi... video!
Not forgetting...

- Safe and sustainable
- Energy minimising
- Ethic development (no Big Brother...)
- Privacy
- Security

- ... and women;-)!