Accessible ICT and Multimodality for Education.
Two Italian Models

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Focus on

- The new obligations contracted by the States Parties to the Convention on the Rights of Persons with Disabilities
  - compulsory reasonable accommodation in education

Outline:

1. Effectiveness of the Italian Model and Politecnico di Milano implementation for employment
2. A sample of Advanced R&D for Accessible ICT
3. Alternative methods: Multimodality and Communication at Esagramma (Milano)
Focus on

- **Two Italian Models**
  - **Politecnico di Milano**: a university for Engineers, Architects and Designers (162 students with sensorial, physical, and psychiatric disabilities, 45 students with dyslexia)
  - **Esagramma**: a specialized rehabilitative center using multimodal artistic pathways with more than 180 kids and adults with cognitive and relational impairments

- **Three main ideas**:
  - Encourage everybody (from childhood) to use a personalized ‘object’
  - Make ‘accessible’ a specialized team of experts
  - Encourage strict relationships with Research & Development
1. The Politecnico di Milano Model

- **Education is for adult life**
  - To build a “professional self” (it’s important for everybody to become expert and exercise specific responsibilities in different contexts)
  - For employment, cultural and social responsibility

- **Educational environments are small but complex and significant social and cultural contexts**
  - Where people study, teach, work, cooperate, communicate, research
  - Many persons cooperate with different abilities and disabilities.
  - Everybody can experience autonomous and cooperative dimensions possibly supported by innovative strategies
1. The Politecnico di Milano Model

- At Politecnico di Milano
  - 207 young men and women with disability study to become engineer, architect or designer

- In Italy:
  - A special Law (number 17/99) guarantees financial supports to organize special services to make the academic life more and more accessible.
  - Each university receives funds in relationships to the number of students with disability, the special projects which support them in studying and facing the first employment experiences.
  - CNUDD groups the Dean’s Delegate for Disability of each university allowing them coordination, global policies and exchange of innovative strategies.
1. The Politecnico di Milano Model

- At Politecnico di Milano: **MultiChancePoliTeam** is the group of specialists which guarantees services to students with disabilities ([www.polimi.it/disabilita](http://www.polimi.it/disabilita))
  - A psycho-educational counseling
  - University attendance support (admission test, tutoring, personalized examinations, accessibility to the campus, administrative, accommodation and studying supports)
  - Teaching aids: conditions specifically suited to maximize the benefit of classroom and laboratory work by means of personalized and innovative technological teaching aids (Text To Speech & Automatic Speech Recognition technologies)
1. The Politecnico di Milano Model

- The MultiChancePoliTeam guarantees services to the students with disability:
  - Technological aids (HW and SW solutions for personal needs)
  - The Wireless Campus allows a personalized fruition of classrooms and laboratory activities, Internet and local services, ....
  - Distance Learning (only when strictly needed)
  - International mobility
1. The Politecnico di Milano Model

- Results in Employment
  - Students with disabilities with technical degrees from Politecnico di Milano: **0% unemployment rate** over 7 years
  - **First year** of employment **supported by the University** with government funds
  - All students, once they have experienced **good assistive technologies keep using it** for their private and professional lives
  - Programs help **employers better adapt the work environment** to persons with disabilities
2. Research & Development

The UBICAMPUS project

- To navigate and explore a wireless campus
- To obtain complete accessibility of global and local information (often changing daily)
- To communicate with the other protagonists of the academic life
- To handle emergencies and to be localized
- To obtained personalized services based on a specific profile (using an extended version of the WHO – ICF Model – named ICF*)
- To adopt innovative solutions for independent life
2. Research & Development

- **The Campus Tools (CATS) project: multimodal access to lectures**
  - Facilitate lip-reading for deaf or hard of hearing students
    - Video stream of lip movements
    - Audio
    - Captioning by ASR
2. Research & Development - PoliLips

- Lips-reading for def students

- In a single integrated solution we mix the three information modalities we can collect from the teacher:
  - visual (lips-reading),
  - aural (ampl.signals),
  - and textual (generated by an ASR application)
2. Research & Development

• The Campus Tools (CATS) project: multimodal access to lectures (cont.)
  - To facilitate notetaking
  - To mix slide objects and hand notes: PoliNotes
  - Additional innovative devices: IrisPen, IrisNote, LiveScribe, …
2. Research & Development - PoliNotes

- Slides shown by the teacher are subdivided in objects
- And sent in real time to the student’s Tablet-PC
- The contents can be rearranged on the electronic sheet
- The student can also add notes and drawings using a stylus
2. Research & Development

PoliNotes

Naïve Bayes

\[ H = \{ h_1, h_2, \ldots \} : \text{hidden state} \]
\[ O_j = \{ o_1, o_2, \ldots \} : \text{observed values} \]

\[
p(H | O_{1:k}) = \frac{p(O_{1:k} | H)p(H)}{p(O_{1:k})} = \prod_j p(O_j | H)p(H)
\]

\[
\hat{h} = \arg\max_H p(H | O_{1:k}) = \arg\max_H \frac{p(O_{1:k} | H)p(H)}{p(O_{1:k})}
\]

\[
= \arg\max_H \prod_j p(O_j | H)p(H)
\]

\[
= \arg\max_H \prod_j p(O_j | H)p(H)
\]

Naïve Bayes

- \( H = \{ h_1, h_2, \ldots \} \): hidden state
- \( O_j = \{ o_1, o_2, \ldots \} \): observed values

\( H \) is a discrete stochastic var that assumes values in \( \{ h_1, h_2, \ldots \} \) (finite set)

\( O_j \) are \( K \) discrete stochastic var that assumes values in \( \{ o_1, o_2, \ldots \} \) (finite set)

Bayes' Theorem

\( H_p: O_{1:k} \text{ independent} \)

\[
p(H | O_{1:k}) = \frac{p(O_{1:k} | H)p(H)}{p(O_{1:k})} = \prod_j \frac{p(O_j | H)p(H)}{p(O_j)}
\]

\[
\hat{h} = \arg\max_H p(H | O_{1:k}) = \arg\max_H \frac{p(O_{1:k} | H)p(H)}{p(O_{1:k})}
\]

\[
= \arg\max_H \prod_j \frac{p(O_j | H)p(H)}{p(O_j)}
\]

\( \text{as } p(O_{1:k}) \text{ does not depend on } H \)
2. Research & Development

• Project: *Natural Language Processing for learning and communicative impairments*
  
  • To improve accessibility of textual and vocal contents
  • To support language learning and communication
  • To analyse vocal and communicative skills
  • To predict, summarize, correct, and support verbal and non verbal expression
2. Research & Development: Text Semplification – Keaki Project

- Domain description
  - Based on ontology (a knowledge base)
- Summarization
- Inference
- Mental map generation for Dyslexia
2. Research & Development: Keaki Project

MULTICHANCE
POLITEAM
3. The Esagramma Model

- Multimedia communication and expression
- Language and voice rehabilitation
- Multimodal psychotherapy
3. Esagramma

Music

Virtual

Opera
3. Esagramma
Music
Virtual Opera
3. Research & Development

- Virtual Environments:
  - Multimodal communication and
  - Artistic production
  - For kids and adults with cognitive disabilities and Autism
3. Research & Development

- Virtual Reality
  - education
  - rehabilitation
3. A Symphonic Model for adult life!
Thank You!

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