
Master degree in biotechnologies and applied artificial intelligence for health: una nuova laurea per una nuova professione

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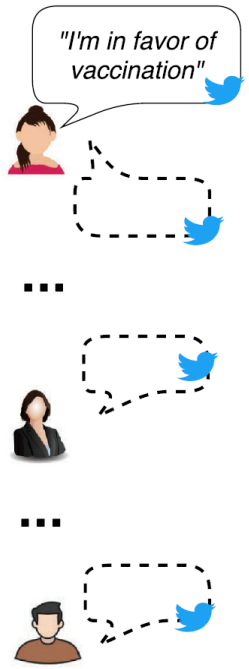
*Polo Didattico S. Rossore 1938 – Via Risorgimento 23*

## Automatic monitoring of the stance of Twitter users towards vaccination topic




**STANCE DETECTION FROM TEXT**

| | |
|---|---|
| **Input** | 1) Raw text for each tweet<br>2) Classification pipeline |
| **Output** | Class of stance for each tweet |

**USER STANCE ANALYSIS**

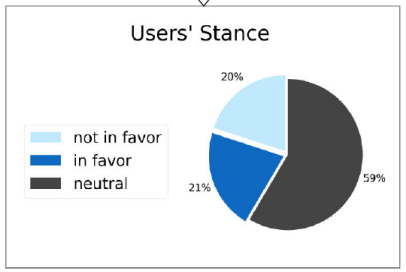
| | |
|---|---|
| **Input** | Set of tweets from each user along with their predicted stance |
| **Output** | Class of stance for each user (in favor, not in favor, neutral) |

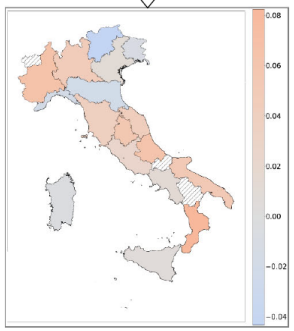
**GEO-SPATIAL ANALYSIS**

| | |
|---|---|
| **Input** | Set of users from each region along with their predicted stance |
| **Output** | Class of stance for each region |

**CLASSIFICATION PIPELINE AND MODEL PARAMETERS**

| | |
|---|---|
| **Text preprocessing** | Removal of links, mentions, special characters. Conversion to lower case |
| **Stop word filtering** | Snowball Tartarus list for Italian. |
| **Bag of word representation** | Tokenization considering *n*-grams as tokens with *n* up to 2 |
| **Stem fitering** | Snowball Tartarus: Porter's algorithm |
| **Numerical features representation** | TF-IDF index.<br>Feature selection (Information Gain) |
| **Classification model** | SVM (Platt's algorithm), linear kernel |

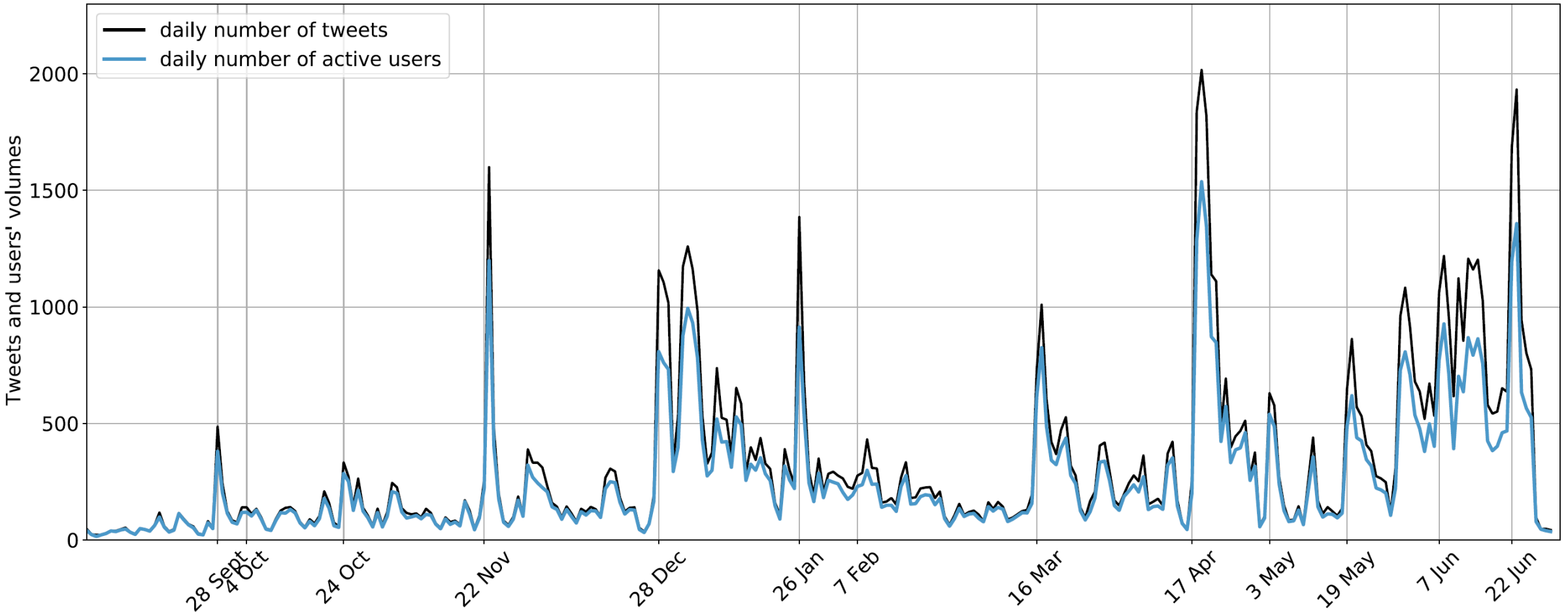


L. Tavoschi, F. Quattrone, E. D'Andrea, P. Ducange, M. Vabanesi, F. Marcelloni, P. L. Lopalco, "Twitter as a sentinel tool to monitor public opinion on vaccination: an opinion mining analysis from September 2016 to August 2017 in Italy", *Human Vaccines & Immunotherapeutics*, Taylor & Francis on-line, Vol. 16 N. 8, 2020, DOI: 10.1080/21645515.2020.1714311

# LE SFIDE DELLE TECNOLOGIE DIGITALI PER LA SALUTE DEL FUTURO

## Increase of tweets in correspondence with specific events



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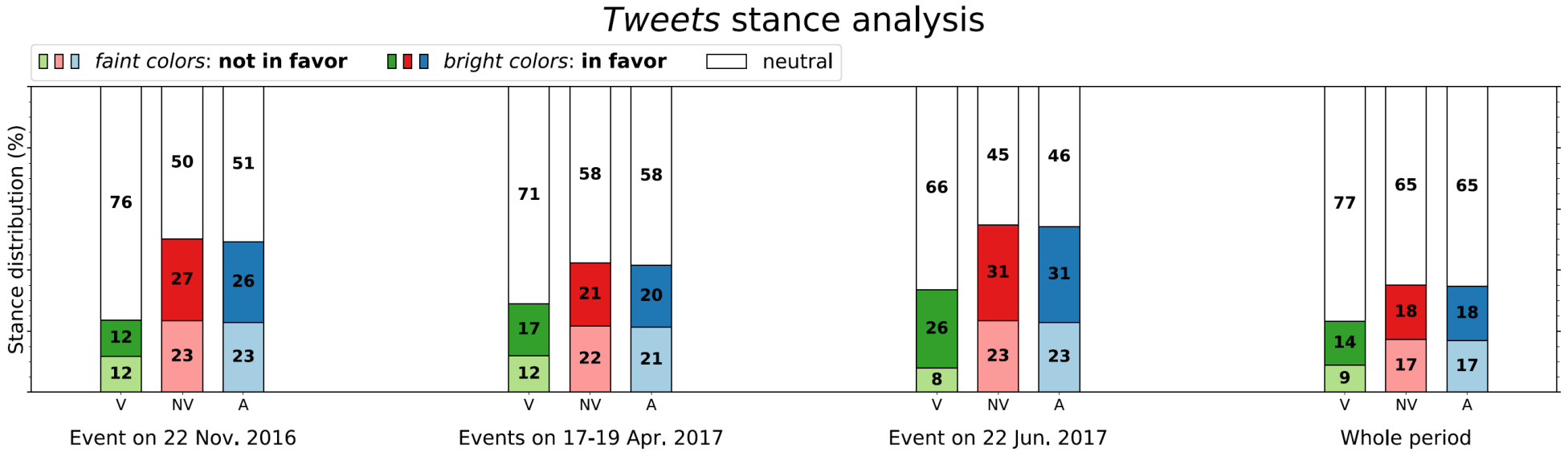
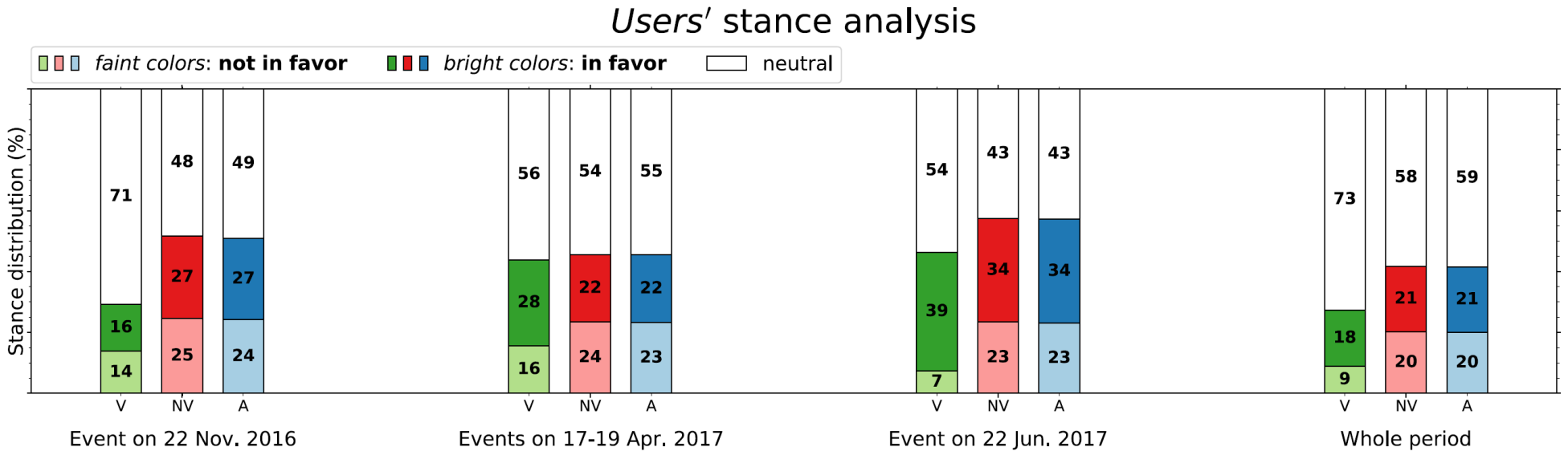



(a)



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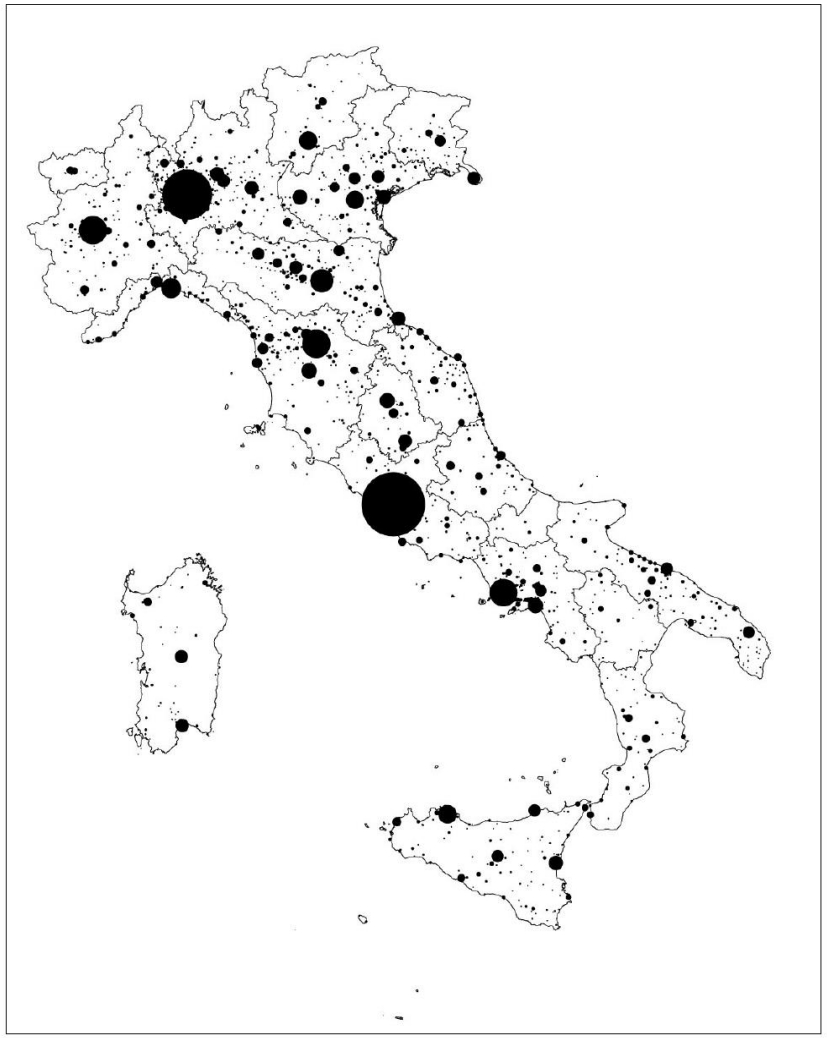

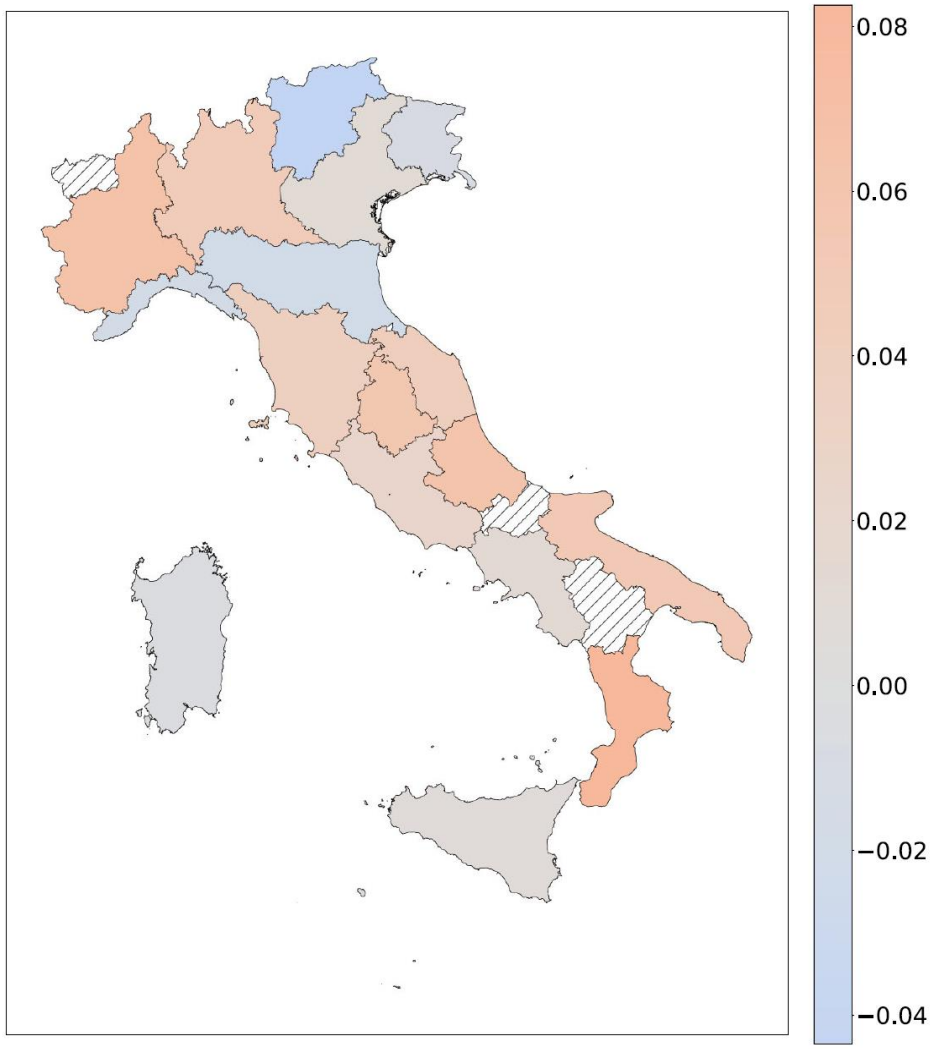


A. Bechini, P. Ducange, F. Marcelloni, A. Renda, “Stance Analysis of Twitter Users: the Case of the Vaccination Topic in Italy”, IEEE Intelligent Systems, Vol. 36, N. 5, pp.131-139, DOI: 10.1109/MIS.2020.3044968, 2021

# LE SFIDE DELLE TECNOLOGIE DIGITALI PER LA SALUTE DEL FUTURO

- Multidisciplinarity: very frequent in research

- Very limited in teaching programmes (some Master of Sciences, more frequent Masters)
  - Constraints imposed by the legislation which brings the few cases we have to be too much oriented
  - Working world not ready yet: Multidisciplinarity often used, but not actually desired at least in some fields

Nevertheless

- Some competences are becoming fundamental and basic for each discipline
  - Data analysis and mining
  - Artificial Intelligence foundations

# LE SFIDE DELLE TECNOLOGIE DIGITALI PER LA SALUTE DEL FUTURO

**Master degree in "Biotechnologies and applied artificial intelligence for health"**

- Which was the spark that gave the way?
  - Contacts with the Aix-Marseille University
  - **Call Digital Europe Programme (DIGITAL)**
    - New EU funding programme focused on bringing digital technology to businesses, citizens and public administrations
    - Five key capacity areas: supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the economy and society, including through Digital Innovation Hubs

# LE SFIDE DELLE TECNOLOGIE DIGITALI PER LA SALUTE DEL FUTURO

**Master degree in "Biotechnologies and applied artificial intelligence for health"**

- Which are the job market needs in the biomedical and biotechnology fields?
  - Digital pathology/high throughput imaging is becoming increasingly relevant in biomedical/biotechnology field
  - Biotech companies offering AI-based genomics services and analyses need bioinformatics/data engineering professionals with integrated competences in biology and genetics
  - Bioengineering applications in biology and medicine needs multi-disciplinary skills, knowledge and competences

## *"Biotechnologies and applied artificial intelligence for health": the project*

- *Why*: the project aims to prepare graduates/professionals with advanced digital skills (according to EU Digital Strategy) and advanced skills in biotechnologies, able to bring the innovation and power of AI to health.
- *Degree class*: LM-9 Medical, Pharmaceutical and Veterinary Biotechnologies
- *Language*: English

## *"Biotechnologies and applied artificial intelligence for health": the project*

- *Tracks*: 1 for students with a background in biology/biotechnologies, 1 for students with a background in computer/data science
- *Professional Profile*: Biologist / Biotechnologist (Cod. ISTAT 2.3.1.1.1, 2.3.1.1.4). Graduates will have a peculiar and highly skilled professional profile and will have managing roles requiring deep knowledge on AI technology in the context of Medical Biotechnologies

# LE SFIDE DELLE TECNOLOGIE DIGITALI PER LA SALUTE DEL FUTURO

## CURRICULUM BIOLOGY 1st YEAR

| I Anno-I Semestre: Insegnamento | Modulo | SSD (CFU) | CFU |
|---|---|---|---|
| Artificial Intelligence I | | ING-INF/05 (6) | 6 |
| Advanced Biochemistry | | BIO/10 (6) | 6 |
| *Probability and Biostatistics* | | *ING-INF/06 (6)* | *6* |
| *Bioinformatics and in silico models* | *Bioinformatics* | *INF/01 (3)*<br>*ING-INF/05 (3)* | *12* |
| | *In silico models* | *CHIM/08 (6)* | |
| | | | **30** |

| I Anno-II Semestre: Insegnamento | Modulo | SSD (CFU) | CFU |
|---|---|---|---|
| Artificial Intelligence II | | INF/01 (6) | 6 |
| Physio-pathology | | BIO/09 (3)<br>MED/04 (3) | 6 |
| Biotechnologies applied to sense physiology | | BIO/09 (6) | 6 |
| *Smart materials and sensors* | *Sensors* | *ING-INF/01 (6)* | *12* |
| | *Smart materials* | *ING-INF/06 (6)* | |
| | | | **30** |

# LE SFIDE DELLE TECNOLOGIE DIGITALI PER LA SALUTE DEL FUTURO

## CURRICULUM ENGINEERING 1st YEAR

| I Anno-I Semestre: Insegnamento | Modulo | SSD (CFU) | CFU |
|---|---|---|---|
| Artificial Intelligence I | | ING-INF/05 (6) | 6 |
| Advanced Biochemistry | | BIO/10 (6) | 6 |
| *Biology of Cellular Systems* | | *BIO/06 (6)* | *6* |
| *Genetics and Molecular Biology* | *Genetics and Genomics* | *BIO/18 (6)* | *12* |
| | *Molecular Biology* | *BIO/11 (6)* | |
| | | | **30** |

| I Anno-II Semestre: Insegnamento | Modulo | SSD (CFU) | CFU |
|---|---|---|---|
| Artificial Intelligence II | | INF/01 (6) | 6 |
| Physio-pathology | | BIO/09 (3)<br>MED/04 (3) | 6 |
| Biotechnologies applied to sense physiology | | BIO/09 (6) | 6 |
| *Microbiology and Public Health* | *Microbiology and microbial biotech* | *BIO/19 (6)* | *12* |
| | *Health risk assessment* | *MED/42 (6)* | |
| | | | **30** |

# LE SFIDE DELLE TECNOLOGIE DIGITALI PER LA SALUTE DEL FUTURO

***COMMON COURSE 2ND YEAR***

| II Anno-I Semestre: Insegnamento | Modulo | SSD (CFU) | CFU |
|---|---|---|---|
| Cell Signaling and Imaging Tools | | BIO/10 (3)<br>BIO/19 (3) | 6 |
| Bioengineering and Experimental Models in Health and Disease | | BIO/06 (3)<br>ING-INF/06 (3) | 6 |
| Omics: Biotechnology and AI for Health | | BIO/18 (3)<br>BIO/11 (3) | 6 |
| Job Placement Activities | | (3) | 3 |
| Elective classes (including “Focused lab training”, “Metagenomics”, “Regulatory issues”, “Molecular Genetics and Medicine in the AI-era”) | | | 12 |
| | | | **33** |

| II Anno-II Semestre: Insegnamento | Modulo | SSD (CFU) | CFU |
|---|---|---|---|
| Internship | | | 6 |
| Thesis | | | 21 |
| | | | **27** |

# LE SFIDE DELLE TECNOLOGIE DIGITALI PER LA SALUTE DEL FUTURO

***"Biotechnologies and applied artificial intelligence for health":***

***an interdisciplinary and international teaching project***

- A consortium of 4 Universities (UNIPI, AMU, SU, UAB), 1 research institute (INRIA), 3 start up companies (GenomeUp, Kode, Excellence Therapeutics) won an EU project (AI for Health) funded (3.4 M€) by DG Connect to increase advanced digital skills in the EU space
- 5 kinds of innovative training focused on advanced digital skills
- UNIPI participates with the new master degree in Biotech & AI for Health

## *Conclusions*

- Future is multidisciplinarity
  - Correct balancing among the different disciplines
  - Not a union but an integration
  - Not only an educational process but also a job market process
  - Lifelong learning