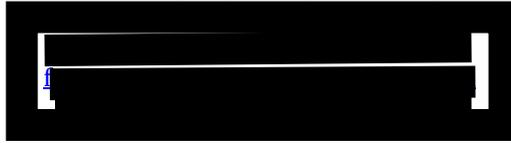# Francesco Montedori

Date of birth: 25/07/1990 | **Nationality**: Italian

WORK EXPERIENCE

Institute of Cognitive Science and Technologies ISTC – Roma

FreeBreath System (European Space Agency - kick start activities for AI).   **Rome, Italy**
01/2020 – now

- **Project title**: *FreeBreath System*
- **Description**: *FreeBreath* is a project funded by the European Space Agency for the construction of a system for monitoring air quality. In particular, FreeBreath collects data from 3 different sources: 1) satellite data (from sentinel 5p and the CAMS system), 2) ground data (from ARPA ground stations) and 3) data from wearable sensors (sensorized masks produced in collaboration with the ACCYOURATE company) and feeds them to an AI running on a cloud. Processed data are provided as an output for several different type of customer (Health, Industry, School and Education provider, City Administration, Scientists and Researchers), in order to supply customers with a more accurate classification of air pollution levels, and a prediction of pollution levels in areas where sensor coverage is lower.
- **Activities in the Project**:
    o Writing the proposal (Technical part);
    o Management of relations with project partners (ESA, SET, Biomedical Campus);
    o Service system architecture design and development;
    o Data mining;
    o Interface Segmentation;
    o Data storage;
    o Web portal design;
    o Artificial Intelligence algorithm design;

Development and management of the ASAI end-of-course project   **Rome, Italy**
11/2019 – now

- **Project Title**: **Increasing Serotonin to reduce parkinsonian tremor**
- **Description**: Starting from the work of Reed and colleagues (2013), we designed a bio-constrained computational model to study the neural mechanisms underlying a possible type of PD tremor: the one mainly involving the serotoninergic system. The simulations run with the model demonstrates that: (i) a physiological serotonin increase can mitigate the progress of tremor by partially recovering dopamine levels in the very early stages of the disease, before the manifestation of overt tremor behaviour. This suggests that monitoring the changes in serotonin concentration could be important for early diagnosis of PD; (ii) it could be possible to devise new pharmacological treatments for tremor that acts on serotonin to recover dopamine level, producing in turn amelioration of tremor behaviour. This latter result has been validated by reproducing existing data collected with humans' patients.
- **Activities in the Project**:
    o Bibliographic research
    o Data mining
    o Design and implementation of the biological model (based on differential equations) in order to reproduce and treat Parkinson disease;
    o Writing the paper (planned to be published by the end of 2020);

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Teacher for the Advanced School in Artificial Intelligence (ASAI)
<div align="right">**Rome, Italy**
01/2020 – 02/2020</div>

- **Course Title**: *Introduction to physical computing - Arduino*
- **Description**: worked for ASAI as a professor for physical computing lessons with Arduino. The course was divided into 3 modules of 2 hours each, during which the students learned:
    1. Overview of the main applications of Arduino boards
    2. Use of development kits provided to students with the aim of understanding the Arduino programming language, the use of sensors and the actuators
    3. Student end of course project management

ECO-Learning - MAIND project
<div align="right">**Rome, Italy**
12/2019 – 06/2020</div>

- **Project Title**: *MAIND*
- **Description**: Preparation of basic scientific lessons on the topic AI for corporate training courses.
- **Topic of the Lectures**:
    - o "Industry 4.0: Information technologies and the Internet of Things."
    - o "The race to Artificial Intelligence by companies, examples and case studies: Google, Amazon and Netflix."
    - o "Artificial intelligence and security problems"
    - o "Artificial Intelligence for emotions recognition"
    - o "Artificial Intelligence for natural language processing and sentiment analysis"
    - o "Artificial Intelligence for Recommendation Systems"
    - o "Artificial intelligence and the Blockchain"
    - o "The impacts of artificial intelligence on global economy"

European Molecular Biology Laboratories EMBL – Roma

Electrophysiology and Computational Data Analysis
<div align="right">**Monterotondo, Italy**
06/2017 – 03/2019</div>

- **Role in the Project**: Trainee at EMBL Roma Hiroki Asari Lab, Roma (Italy);
- **Activities in the Project**:
    - o Studies on Visual System;
    - o Retina surgery, Multi-Electrode-Array electrophysiological records, Brain Slicing and Image Acquisition;
    - o Visual stimuli design and processing (Python & QDSpy);
    - o Design of 3D-printed instruments;
    - o Drug administration;
    - o Manage scientific databases;
    - o Data analysis;

EDUCATION

Advanced school in artificial intelligence (AS-AI), CNR-ISTC
<div align="right">**Rome, Italy**
10/2018 – 03/2019</div>

- **Final Project Title**: Empath-AI: An AI system to recognize human emotion
- **Description**: *Empath-AI* is based on the theory developed by (Bradley and Lang, 1995). Motivational states can be represented in a continuous two-dimensional space: *Valence*: indicates whether a motivational state is positive or negative; *Arousal*: the degree of activation refers to the intensity of the physiological responses of a motivational state. Generally speaking, the different motivational states can be grouped into three broad classes: 1) *Appetitive motivation*: high valence and high arousal. 2) *Low motivation*: medium valence and low arousal. 3) *Defensive motivation* low valence and high arousal. The three motivational states generate specific changes in autonomic

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activity measurable through different peripheral physiological parameters including electrodermal activity (EDA). By stimulating different subjects with images that induce the three different motivational states, it is possible to collect EDA measurements and use them to train one-dimensional convolutional networks (CNN-1D) to associate the electrodermal activity of a subject with a specific class of motivational state.
- **Role in The Project**: Software and AI Developer

Master's Degree in Neurobiology, Università La Sapienza

Rome, Italy
10/2014 – 03/2019

- **Thesis Title**: ''Testing the effect of serotonin on the visual response of mouse retinal ganglion cells''
- **Description**: We used multi-electrodes arrays (MEAs), to study how serotonin modulates the activity of retinal ganglion cells in dissected mouse retinas responding to different patterns of visual stimuli. Consistently, we found two effects of serotonin on the retinal activity. First, serotonin generally slowed the response kinetics to visual stimuli. Second, serotonin increased the baseline spiking activity of ON and ON-OFF cells, whereas it decreased that of OFF cells. These data were still very preliminary because the sample size was small. Nevertheless, our data support that serotonin plays a role in centrifugal modulation of the mouse retina.
- **Thesis subject**: Electrophysiology
- **Thesis Advisors**: Prof. Giancarlo Poiana (Università La Sapienza)
- **External Advisor**: Dott. Hiroki Asari (EMBL - Monterotondo)
- **Final Grade**: 110/110 cum Laude. Average mark: 28.4/30

Bachelor Degree in Biotechnology, Università La Sapienza

Rome, Italy
10/2009 – 7/2014

- **Thesis Title**: Antibiotic resistance mechanisms of the bacterial strain MG-1655 in relation to the D-potE and D-potJ protein pumps
- **Description**: In this thesis we wanted to evaluate the role (direct or indirect) in drug resistance of two protein systems classified among transporters as PotE (AEC family Transporters) and MdtJI (SMR family Transporters), two specific transporters of polyamines spermidine and putrescine. The interest in these two systems in relation to drug resistance arises from the observation that the levels of polyamines such as putrescine and spermidine have been related to resistance to specific antibiotics. In this thesis work we therefore set ourselves the goal of creating E. coli strains that are defective for one of the two or both transport systems, and to evaluate their effects on sensitivity / resistance to the most common antibiotics through spot tests on medium containing the 'antibiotic and through the analysis through the use of specific antibiogram "strips" that allow to evaluate the value of minimum inhibitory concentration (MIC) for each of the antibiotics.
- **Thesis Subject**: Microbiology
- **Thesis Advisor**: Gianni Prosseda (Università La Sapienza)
- **Final Grade**: 103/110. Average mark: 24.5/30

High School Diploma, T. Mamiani Roma (Italy)

Rome, Italy
2004/2005 – 2008/2009

- Classical, Scientific School - Scientific Project "Brocca"
- **Final Grade**: 66/100

PUBLICATIONS

- **FreeBreath Final Deliverable**:
  - o **Status**: in preparation;
  - o **Authors**: Francesco Montedori (CNR-ISTC), Fabio D'Amore (CNR-ISTC), Vittorio Cannas (SET), Stefania Amici (SET)
  - o **Year**: 2020/2021

- **Increasing serotonin to reduce parkinsonian tremor**:

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- o **Status**: in preparation;
- o **Authors**: Daniele Caligiore (CNR-ISTC) Francesco Montedori (CNR-ISTC), Silvia Buscaglione (CNR-ISTC), Adriano Capirchio (CNR-ISTC)
- o **Year**: 2020

SKILLS, ACTIVITIES & INTERESTS

Languages
- Italian: Native
- English: Advanced
- French: Elementary

BIO Skills:
- *In vitro/In vivo* Electrophysiology
- Genome analysis
- Plasmid DNA extraction
- Electrophoresis on agarose gel;
- PCR and RT-PCR
- Transformation with calcium chloride
- Electroporation transformation;
- Phage transduction
- MIC Test Stripes
- Protein purification
- Immunohistochemistry
- Flow cytometry

IT Skills:
- Programming: *Python (Advanced); C (Basic); Java (Basic); Android studio (Basic)*; *R (statistical analysis - Basic);*
- Libraries: Numpy, OpenCV, Pandas, Socket, Matplotlib
- AI development: TensorFlow, Keras
- Data processing
- Data analysis

NEURO Skills:
- Usage of Brain Atlas
- Eye and brain surgery
- Neurotracing
- Brain Injection

TECH Skills:
- Bio-sensor: Empatica E4; Pupil labs eye-tracker; Biograph Infinity; MEA – Multi Electrode Array; Biosignal Plux;
- Two Photon microscope and Optical microscopes
- 3D – printer (Ultimaker S) and software design
- Arduino: UNO, DUE, NANO, MINI;
- Raspberry: Pi3, Pi4
- PC repair

Driving license:
- B/A2/A

Curricular Activities:
- Student educational activity on AI applications for primary and secondary schools at 13th edition of Rome Cup, the multy-event promoted by the Fondazione Mondo Digitale to promote young Italian talent and the innovation ecosystem in robotics, artificial intelligence and life science.

Extracurricular Activities:

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- Scouting - Scout Squad at Agesci Roma 8 - Parish Christ Re
- Head of logistics at ''Good Game'' cultural association

Other interests:
- Travel (Europe, Asia, US, Africa)
- Sailing
- Hiking and Trekking
- Mechanics, Electronics, Chemistry, Psychology, Botanic, Astronomy, E-sports.

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