The undersigned David, pursuant to and for the purposes of the provisions contained in Articles 46 and 47 of the Decree of the President of the Republic No. 445 of 28 December 2000 and subsequent amendments, aware of the consequences arising from false declarations pursuant to Art. 76 of the aforementioned D.P.R. No. 445/2000, under his own responsibility,

DECLARES AND CERTIFIES AS TRUTHFUL

the following Curriculum Vitae, including the qualifications submitted for evaluation, dated and signed below.

Curriculum Vitae of Dr. David Perpetuini

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1. ACADEMIC POSITION, PERSONAL INFORMATION, EDUCATION

Fixed-term Researcher on a tenure track (RTT) pursuant to Article 24, paragraph 3, of Law 240/2010 (as amended by Law No. 79/2022), at the departmental Faculty of Medicine of Unicamillus – Saint Camillus International University of Health Sciences in Rome, GSD 02/PHYS-06, SSD PHYS-06/A.

Main research activity: Affective computing based on infrared imaging and its applications in human-machine interaction and ergonomics. Integration of wearable sensors in an Internet of Things context for monitoring the psychophysiological condition, sleep quality and cardiovascular risk.

(https://www.scopus.com/authid/detail.uri?authorId=57196390915)

Education

PhD in Neuroscience and Imaging, curriculum in methods, models and instrumentation for imaging (XXX cycle), at the Department of Neuroscience, Imaging and Clinical Sciences (DNISC) of the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy), SSD FIS/07, SC 02/D1.
Assessment: EXCELLENT
Thesis Title: Complexity analysis of fNIRS signal: validation and clinical application (Supervisor: Prof. Arcangelo Merla)

Main subjects studied:

- Study of brain activity by functional near-infrared spectroscopy (fNIRS) in adults, the elderly, and patients with Alzheimer's disease and Autism.
- Study of the relationship between complexity variations (sample entropy) in the fNIRS signal and brain activity.
- Study of autonomic activity in Alzheimer's patients by thermal imaging and modelling of skin temperature variation in response to stress.

Master's Degree in Biomedical Engineering (LM-21) at the Marche Polytechnic University, Faculty of Engineering (Ancona, Italy).
Grade: 110/110 cum laude
Thesis Title: Use of a low-cost markerless sensor for the assessment of motor gestures in patients with Parkinson's Disease (Supervisor: Prof. Sauro Longhi)

Main subjects studied:

- Analysis of postural control ability in subjects with different pathologies through the analysis of signals from force platforms, electromyographic sensors and basographic sensors.
- Use of the Kinect sensor to search for characteristic features of Parkinson's Disease in early-stage patients during the performance of specific motor tasks, in combination with a mobile platform, as a starting point for the development of a device for the support, monitoring and analysis of movement aimed at patients with Parkinson's Disease (Internship at the DII – Department of Information Engineering).

Bachelor's Degree in Biomedical Engineering (D.M. 509/99, class 10 – class of degrees in industrial engineering) at the Marche Polytechnic University, Faculty of Engineering (Ancona, Italy).
Grade: 110/110 cum laude
Thesis Title: Efficient implementation of identification algorithms based on the Karhunen–Loève transform and on wavelet approximation techniques (Supervisor: Prof. Paolo Crippa)

Main subjects studied:

- C++ implementation of a Wavelet-based identifier that exploits the relationships intrinsically characterizing a limited set of realizations through the separation properties of the Karhunen–Loève transform (Internship at DIBET – Department of Biomedical Engineering, Electronics and Telecommunications).

Second-Level Academic Diploma in Saxophone, performance-composition curriculum, at the Gaetano Braga Higher Institute of Musical and Choreutic Studies (Teramo, Italy).

Grade: 110/110 cum laude

Thesis Title: From the stage to the laboratory: assessment of the physiological and neural correlates associated with the performance of Eugène Bozza's pieces for saxophone (Supervisor: Prof. Fabrizio Benevelli)

Main subjects studied:

- Solo performance practice and ensemble music;
- orchestral rehearsals, wind ensemble music and chamber music.
- Investigation of the interaction between two musicians during the performance of Bozza's Aria, assessed through hyperscanning approaches based on electroencephalography and electrocardiography.

First-Level Academic Diploma in Saxophone, performance-composition curriculum, at the Gaetano Braga Higher Institute of Musical and Choreutic Studies (Teramo, Italy).

Grade: 110/110 cum laude

Thesis Title: Glazunov and the saxophone: a historical, stylistic and emotional investigation (Supervisor: Prof. Fabrizio Benevelli)

Main subjects studied:

- Solo performance practice and ensemble music;
- orchestral rehearsals, wind ensemble music and chamber music.
- Investigation of the physiological responses measured through thermography, electrocardiography and thermography associated with listening to Glazunov's Concerto in E-flat major Op. 109 by saxophonists and non-expert listeners. Supervised machine learning methods were used to classify the listeners' emotional state according to Russell's circumplex model of emotions.

Second-Level Academic Diploma in Chamber Music, performance-composition curriculum, at the Gaetano Braga Higher Institute of Musical and Choreutic Studies (Teramo, Italy).

Grade: 110/110 cum laude

Thesis Title: Mendelssohn and his time (Supervisor: Prof. Sergio Piccone Stella)

Main subjects studied:

- Solo and chamber performance practice;
- harmonic analysis;
- history of music.
- Harmonic and stylistic analysis of Mendelssohn's main compositions for clarinet, contextualizing them historically and geographically.

Clarinet Diploma (Old System) at the Gaetano Braga Higher Institute of Musical and Choreutic Studies (Teramo, Italy).

Grade: 10/10 cum laude

Main subjects studied:

- Instrumental performance practice (clarinet)
- history of Music;
- complementary harmony;
- orchestral rehearsals, wind ensemble music and chamber music.

Language Skills: Written and spoken English at C1 level according to the Common European Framework of Reference for Languages (CEFR).

Technical Skills:

- Good knowledge of the Windows and Ubuntu operating systems;
- excellent knowledge of the Matlab environment;
- good knowledge of the Python programming language;
- excellent knowledge of the IBM SPSS statistical analysis software;
- excellent knowledge of the Prism – GraphPad statistical analysis software.

2. INFORMATION ON THE SCIENTIFIC AND PROFESSIONAL PATH

July 2023 – June 2026	Fixed-term Researcher, full-time, pursuant to and for the purposes of Art. 24, paragraph 3, letter a) of Law 240/2010, S.C. 09/G2 BIOENGINEERING, S.S.D. ING-IND/34 Industrial Bioengineering, at the Department of Engineering and Geology (INGEO) of the University "G. d'Annunzio" of Chieti-Pescara (Pescara, Italy).
2018 – June 2023	Research Fellow: "Development of models and algorithms for the estimation of vascular parameters through multisite PPG-ECG measurements" at the Department of Neuroscience, Imaging and Clinical Sciences (DNISC) of the University "G. d'Annunzio" of Chieti-Pescara (Chieti, Italy), SSD FIS/07, SC 02/D1. Main research activity: Affective computing based on infrared imaging and its applications in human-machine interaction, robotics and automotive. Multimodal fNIRS-EEG and PPG-ECG integration and their applications in basic and applied neuroscience.
2016 – 2017	Visiting Scholar at the Department of Medical Physics and Biomedical Engineering and the Institute of Cognitive Neuroscience (ICN) of University College London (UCL) (London, UK). Main research activity: Study of brain activity alterations in autistic subjects through fNIRS during prospective memory tasks.
2014 – 2017	PhD in Neuroscience and Imaging, curriculum in methods, models and instrumentation for imaging (XXX cycle), at the Department of Neuroscience, Imaging and Clinical Sciences (DNISC) of the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy), SSD FIS/07, SC 02/D1. Main research activity: Study of brain activity by functional near-infrared spectroscopy (fNIRS) in adults, the elderly and patients with Alzheimer's disease.

3. SCIENTIFIC RESEARCH

3.1 Main research fields and current research interests

Throughout his scientific career, Dr. Perpetuini has worked on topics of biomedical engineering and physics applied to medicine, with a specific focus on the development of methods, models, systems and software for the use of infrared imaging in computational psychophysiology, applied neuroscience and medical diagnostics.

Dr. Perpetuini's main research lines are:

1. Development of methods, models and applications for biomedical functional imaging and computational psychophysiology in the thermal infrared;
2. Development of methods, models and applications for fNIRS – functional Near Infrared Spectroscopy;
3. Multimodal integration and development of new sensors;
4. Smart Wearables;
5. Innovative signal and image processing methods for infrared and near-infrared imaging data.

The research activity has been applied to various fields, the most recent and currently ongoing of which are:

1. Human-machine interaction;

2. Affective computing;
3. Non-invasive imaging study of the neuro-psycho-physiological correlates of physical exercise;
4. Ageing;
5. Rehabilitation;
6. Diagnostic Imaging.

Given the intrinsically interdisciplinary nature of his research, Dr. Perpetuini has developed excellent collaborative working skills with researchers from different scientific fields, such as engineering, computer science, artificial intelligence, biology, medicine, neuroscience, psychology and sport sciences.

3.2 Detailed description of research activity

Dr. Perpetuini's scientific activity focuses on the research and development of new biomedical applications of thermal infrared imaging (IRI), near-infrared imaging (i.e. functional near-infrared spectroscopy, fNIRS, and photoplethysmography, PPG), and electrophysiological imaging (i.e. electroencephalography, EEG, and electromyography, EMG). Dr. Perpetuini's expertise mainly concerns the modelling of biophysical processes based on artificial intelligence (AI) and Machine Learning (ML) approaches, the development of platforms and algorithms for the acquisition and processing of biosignals, and the experimental validation of methods and models. Recently, Dr. Perpetuini has begun developing affective computing modules based on AI algorithms for anthropomorphic robotic platforms.

Functional imaging in the thermal and near infrared and its applications in medicine

Dr. Perpetuini has used pattern recognition and AI algorithms to study several important pathologies. Specifically, Dr. Perpetuini demonstrated the possibility of classifying the stages of Raynaud's disease even without administering functional tests, using only resting thermographic images of the patients' hands through the use of deep convolutional neural networks (Applied Sciences, 2021).

In addition, Dr. Perpetuini contributed to the development of a procedure for tracking facial anatomical points and a warping procedure to be applied to thermal videos, useful for the automatic identification of salient morphological and functional features (Infrared Physics and Technology, 2021).

Furthermore, Dr. Perpetuini is carrying out research in collaboration with the Complex Operating Unit of Neurosurgery of the Pescara hospital for the development of intraoperative neurosurgical functional brain mapping procedures of tumor areas based on thermal infrared imaging, in order to maximally preserve healthy tissue. In this case, the exposed tissue is thermally stimulated with cold saline solution, and the thermal recovery is monitored and characterized in the frequency domain on the thermal signals extracted for each pixel in the region. Using ML models, it is possible to distinguish healthy from pathological tissue with an accuracy greater than 94%. The study has been submitted for publication to Physical and Engineering Sciences in Medicine.

Computational Psychophysiology from thermal infrared imaging and photoplethysmography data

Dr. Perpetuini developed an ML-based approach to estimate heart rate variability (HRV) through IRI, using PPG as the gold standard. The method can estimate some HRV parameters with good accuracy in a contactless manner, thus with important potential applications in ecological settings such as driver monitoring in the automotive field. In particular, the developed models yield Spearman correlation coefficients of about 0.7 between the variables measured through PPG and those estimated through thermography (Frontiers in Cardiovascular Medicine, 2022).

Furthermore, Dr. Perpetuini demonstrated the possibility of predicting an individual's state anxiety, assessed through the State-Trait Anxiety Inventory (STAI-Y), through ML algorithms applied to PPG data, obtaining a Spearman correlation coefficient between the anxiety defined by the test and that predicted through PPG greater than 0.8 (PeerJ, 2021).

Functional Near-Infrared Spectroscopy

Within the collaboration with University Hospitals Birmingham NHS Foundation Trust, Birmingham, United Kingdom, several NIRS studies were conducted on the possibility of using indocyanine green to perform high-contrast dynamic NIRS spectroscopy for the study of moderate or severe brain trauma injuries (Quantitative Imaging in Medicine and Surgery, 2020; Journal of Cerebral Blood Flow and Metabolism, 2020). In addition, studies were conducted on the possibility of using fNIRS tomography in the clinic for the treatment of patients with acute sport-related brain injuries (International Journal of Molecular Sciences, 2020).

Furthermore, Dr. Perpetuini developed a motion artifact correction procedure for fNIRS signals based on the wavelet transform of the fNIRS signal and of the optode movement (assessed through video tracking), together with their wavelet coherence. The inverse wavelet transform was computed for the fNIRS signal, excluding the frequency content corresponding to the optode movement (Sensors, 2021).

Affective computing and human-machine interaction

Dr. Perpetuini has worked on the development and use of computational psychophysiology and affective computing methods, based on infrared imaging as an information channel on the user's psychophysical state in human-machine interaction. The research activities in this field were carried out within the following projects.

MIUR PON SI-ROBOTICS – Healthy and active ageing through SocIal ROBOTICS, funded under the specialization area: Technologies for Living Environments. The project envisaged the development of assistive robotic platforms for the elderly, both in hospital or sheltered settings and in the home environment. The research activity in which Dr. Perpetuini participated consisted of making the robotic platforms, developed by the BioRobotics Institute of the Scuola Superiore Sant'Anna in Pisa, capable of understanding, in real time, the user's psychophysiological state and enabling them to adopt behaviors consistent with the user's needs. To this end, Dr. Perpetuini developed algorithms optimized for use on a humanoid robotic platform for the analysis of data from signals acquired through a specific hybrid RGB/Depth/LWIR imaging module (Sensors, 2022; QIRT 2022; Sensors, 2021; Applied Science, 2020). The robotic system was successfully tested in clinical settings such as the IRCCS Casa Sollievo della Sofferenza and the IRCCS INRCA of Ancona.

PON MIUR – Industrial Research and Experimental Development Projects in the 12 Specialization Areas identified in the PNR 2015-2020 – Specialization area: Sustainable mobility: Development of advanced technologies and systems for car safety through ADAS+ platforms;

Within the ADAS+ project, which involved the participation of industrial partners such as STMicroelectronics, Dr. Perpetuini developed models and solutions for the continuous estimation of vital parameters of clinical and psychophysiological interest, with the aim of assessing states of drowsiness, excessive cognitive load and stress of the driver through the analysis of infrared thermal signals recorded on the driver's face (Sensors, 2022; Proceedings of SPIE, 2021; IFMBE Proceedings 2021; Applied Sciences, 2020). In particular, Dr. Perpetuini developed a model of the thermal autonomic response to aversive stimuli through a generalized linear model (Sensors, 2019). To build this model, a canonical thermal response to the stimulus was first defined, and the linearity and time-invariance properties of the thermal response were verified. This model was then integrated into an affective computing module capable of assessing in real time the sympathetic or parasympathetic predominance of autonomic activity from facial thermal images, useful for automotive applications.

REHABILITATION ROBOTICS – Infantile cerebral palsy is a non-progressive neurological pathology that represents one of the main causes of spasticity and motor disorders in children. The use of robotic exoskeletons (Robotic-assisted gait training – RAGT) is widely employed to treat this pathology and to improve children's walking abilities. Within the collaboration with the Padre Pio Rehabilitation Centers Foundation, over the past year Dr. Perpetuini has studied two important aspects related to rehabilitation.

- The role of the child's engagement and emotional state during treatment as a reason for the success/failure of RAGT therapy;
- The role of cortical plasticity and reorganization in the success of RAGT therapy.

The two studies, conducted on a sample of ten subjects between 5 and 12 years of age, demonstrated that:

- The assessment through IRI of the psychophysiological state of pediatric patients during RAGT makes it possible to monitor their involvement in the therapy, increasing its benefits (International Journal of Environmental Research and Public Health, 2022);
- The assessment through fNIRS of activations in the sensorimotor and prefrontal cortex makes it possible to implement a cross-validated ML framework capable of estimating the improvement in the gross motor function measure (Journal of Clinical Medicine, 2022).

Multimodal Brain Computer Interface with Optical Imaging, Electroencephalography and Advanced Artificial Imaging. Funding Agency: MindPortal STD. Dr. Perpetuini is engaged in the development of algorithms for Brain-Computer Interface (BCI) applications based on fast optical signals (FOS). Fast optical signals are generated by alterations in the optical properties of neurons during the depolarization phase, due to changes in the diameter of the neurons themselves. These alterations can be detected by near-infrared optical systems and provide brain activity information with a temporal resolution similar to that of EEG and a spatial resolution similar to that of fNIRS, thus proving to be an excellent tool for BCI applications. However, the signal-to-noise ratio (SNR) is low; therefore, Dr. Perpetuini's objective is to develop algorithms for improving signal quality and classifiers based on artificial intelligence algorithms for detecting brain activation states in real time. Recently, Dr. Perpetuini has been combining FOS and EEG signals to increase the performance of brain activation classification through AI algorithms.

Smart Wearables

Starting from 2020, Dr. Perpetuini has included in his research activity the development and validation of smart wearables, with particular reference to the validation of various technologies in the clinical-biomedical field and to the development of diagnostic models or applicative use cases of clinical interest. Within the ITINERE project – Innovation for Wearable Technologies and Advanced Networks of Expert Relations, funded by the Ministry of Economic Development under the Agreements for Innovation, Research and development projects in the applicative sectors consistent with the National Strategy for Intelligent Specialization (SNSI), the aim is to create a stable research and experimentation environment among different technological components that enable the transition to the paradigms of the new 5G services in the life sciences sector, of smart fabrics with which to make smart garments capable of monitoring various physiological parameters, including HRV and respiratory rate, and to validate their use in various applicative fields such as: telemedicine, sport, and extreme work environments. Dr. Perpetuini is responsible for the development of artificial-intelligence-based algorithms for the automatic implementation of individual attention and risk thresholds and profiling, also with reference to the environmental conditions in which the subject operates, through IoT. The smart wearables are developed by Let's srl, while the 5G architecture for data transmission and remote device control is implemented by ZTE. Field tests involve, among others: Italian Red Cross, ENI, Inter FC.

Multimodal integration and development of new sensors

Since 2018, Dr. Perpetuini has participated in the ASTONISH project – Advancing Smart Optical Imaging and Sensing for Health, H2020-EU.2.1.1.7 – ECSEL.

Within this project, Dr. Perpetuini, in collaboration with STMicroelectronics, CNR Catania and the University of Palermo, validated innovative near-infrared optical sensing technologies based on NIR sensors miniaturized thanks to Silicon Photomultiplier (SiPM) technology. In particular, Dr. Perpetuini contributed to needs analysis and functional design, and developed new multimodal fusion strategies for combining EEG and ECG data respectively with data from the fNIRS and PPG optical sensors recorded with SiPM sensors, through the use of intelligent real-time data processing algorithms.

Specifically, the following were developed: a wireline fNIRS-EEG combo system (64 fNIRS channels, 32 EEG channels), a wireless combo system (16 fNIRS channels, 16 EEG channels) and a wireline PPG-ECG combo system

(10 PPG channels, 12 ECG channels) (Sensors, 2020; Sensors, 2019; IEEE EMBC Proceedings, 2019). Through the use of SiPM sensors, greater sensitivity and a better signal-to-noise ratio were achieved for the cortical fNIRS signals (Neurophotonics, 2019).

Dr. Perpetuini has also been engaged in the development of new clinical applications for the study of physiological and pathological ageing, focusing on Alzheimer's disease, based on AI approaches for the early and accurate diagnosis of pathologies through multimodal measurements (ECG-PPG; fNIRS-EEG; fNIRS-IRI).

The applications of multimodal integration to which Dr. Perpetuini has devoted himself are reported below:

- Ageing and vascular and microcirculation dysregulations: within the ASTONISH project activities, Dr. Perpetuini developed innovative machine-learning-based methods for estimating arterial ageing through combined multisite PPG-ECG measurements (Proceedings of SPIE, 2021; Applied Sciences 2020; Medical Engineering and Physics, 2019). Furthermore, since Alzheimer's disease (AD) is characterized by progressive memory deficits accompanied by microcirculation alterations, infrared thermography was applied to investigate peripheral microcirculation alterations in AD patients compared with age-matched healthy controls, in resting-state conditions, through ML approaches. In particular, several classifiers were tested, using as regressors the power of the time course of the nose-tip temperature in different physiological frequency bands. Among the ML classifiers tested, the Decision Tree Classifier (DTC) provided the best cross-validated accuracy (accuracy = 82%) in discriminating between AD and healthy subjects. The results further demonstrate the alteration of microvascular patterns in AD in the early stages of the pathology and the ability of IRI to assess vascular impairments (Bioengineering, 2022).
- Ageing and cognitive decline: Dr. Perpetuini developed methods for the early detection of Alzheimer's disease based on fNIRS and EEG signals acquired during the performance of diagnostic clinical tests (Entropy, 2020; Entropy, 2019; Neurophotonics, 2018) and during resting state, showing dysregulations of neurovascular coupling in patients with Alzheimer's disease (Biomedicines, 2021). Notably, the clinical tests were administered to the patients exactly as they are used in clinical practice; therefore, canonical methods of brain signal analysis based on block and event paradigms proved unusable. For this reason, Dr. Perpetuini developed and validated analysis methods based on the complexity of brain signals.
- Ageing and affective computing: Dr. Perpetuini's objective is to obtain non-invasive instrumental measures of the patient's emotional state during the diagnostic interview with the specialist, thus without resorting to block protocols that are evidently impractical in clinical practice. The analysis of the IRI signal acquired on the patients' faces during the administration of clinical tests highlighted an altered autonomic expression in AD patients compared with controls (Physiological Measurements, 2019; Current Alzheimer Research, 2018).

Dr. Perpetuini has also been interested in IRI-EMG integration to estimate the ability of functional thermography to highlight altered muscular activity in patients with juvenile idiopathic arthritis (IFMBE Proceedings, 2021). Furthermore, Dr. Perpetuini demonstrated the possibility of estimating muscular activity and fatigue parameters from thermal signal features through ML approaches in healthy subjects during bodyweight squat exercise. Specifically, the average rectified value (ARV) and the median frequency of the Power Spectral Density (MDF) were estimated through a Gaussian Process Regression model, obtaining good performance ($r=0.886$ for ARV, and $r=0.661$, $p<0.001$ for MDF). The study has been submitted for publication to the journal Sensors.

Non-invasive imaging study of the neuro-psycho-physiological correlates of human movement

In collaboration with the Department of Biomedical Sciences for Health of the University of Milan, Dr. Perpetuini carried out a study in which, on the basis of previous scientific evidence, the questions were whether: (1) exercise with low movement speed leads to a greater increase in cerebral oxygenation and a greater decrease in muscle oxygenation compared with exercises performed at higher speed, and (2) whether the amount of oxygenation increase in the ipsilateral prefrontal cortex is lower than that in the contralateral one during the performance of a unilateral exercise. The study was conducted using the NIRS technique, with simultaneous measurements in the prefrontal cortex and on the exercising limb. The study showed that physical exercise with low movement speed

was associated with greater muscle deoxygenation compared with normal movement speed. As regards the prefrontal cortex, the contralateral lobe showed a greater increase in oxygenation than the ipsilateral one, thereby demonstrating that movement speed influences the amount of muscle oxygenation (PeerJ, 2018). Since the lack of oxygen in the muscles is associated with an increase in metabolic stress, manipulating movement speed can be useful in planning resistance training programs. In addition, consistent increases in the oxygenation of the right and left prefrontal lobes were found, suggesting a complementary interaction between the ipsilateral and contralateral prefrontal cortex, which also appears to be correlated with fatigue.

In a recent study published in Biology (2022), Dr. Perpetuini demonstrated that facial temperature could provide information on exercise-related fatigue. Through analysis of facial temperature dynamics in the time and frequency domains, significant correlations were found between thermal features and the subject's rate of perceived exertion. These results suggest that infrared thermography could assess both peripheral and central responses to physical exercise (Physiological Measurement, 2021).

Furthermore, Dr. Perpetuini participated in studies demonstrating that it is possible, through Support Vector Machine, to predict athletes' running speed in indoor conditions, in controlled tests, through heart rate measurements and accelerometry data (International Journal of Environmental Research and Public Health, 2021).

Research activity in dentistry and dental hygiene

Dr. Perpetuini participated in a series of studies on the typing of regular and narrow dental implants through IRI, demonstrating the safety of narrow implants in terms of bone tissue necrosis related to the high temperatures generated during the insertion phase (IFMBE Proceedings, 2021).

Innovative signal and image processing methods

Among the most impactful and innovative results, never used before specifically for IRI or fNIRS signals, the following are noteworthy:

- A method based on the sample entropy of the prefrontal fNIRS signal for discriminating between AD patients and controls, during the performance of memory tasks in ecological clinical-interview settings (Neurophotonics, 2018);
- Modelling of the thermal impulse response function for General Linear Model (GLM)-based analyses of IRI signals associated with autonomic activity (Sensors, 2019);
- A motion artifact correction procedure for fNIRS signals based on the wavelet transform of the fNIRS signal itself and of the optode movement, together with their wavelet coherence. The inverse wavelet transform was computed for the fNIRS signal, excluding the frequency content corresponding to the optode movement (Sensors, 2021);
- An automatic warping procedure for facial thermal videos for the automatic identification of salient morphological and functional features (Infrared Physics and Technology, 2021).

3.3 Scientific Collaborations

Since 2025	"G. Braga" Conservatory, Department of Musicology, Teramo, Italy (Prof. Maica Tassone)
2023-2024	Marche Polytechnic University, Department of Information Engineering, Ancona, Italy (Dr. Sabrina Iarlori, Prof. Andrea Monteriù)
Since 2022	Padre Pio Foundation and Rehabilitation Centers, San Giovanni Rotondo, Italy (Dr. Serena Filoni, Physician)
Since 2022	IRCCS Centro Neurolesi Bonino Pulejo, Messina, Italy (Dr. Rocco Salvatore Calabrò, Physician)
2021 – 2022	Department of Psychology, University of Illinois at Urbana-Champaign, IL, United States (Profs. Gabriele Gratton, Monica Fabiani, Neuroscientists)

2021-2022	Department of Biotechnology and Life Sciences (DBSV), University of Insubria, Varese (Prof. Damiano Formenti, Sport scientist)
2020 – 2022	University Hospitals Birmingham NHS Foundation Trust, National Institute for Health Research Surgical Reconstruction and Microbiology Research Centre (NIHR-SRMRC), Birmingham, United Kingdom (Dr. Mario Forcione, Surgeon)
2018 – 2022	Department of Biomedical Sciences for Health, University of Milan, Milan (Prof. Giampietro Alberti, Physician)
2018 – 2022	STMicroelectronics, ADG R&D, Catania, Italy (Eng. Vincenzo Vinciguerra; Dr. Piero Fallica, Physicist)
2018 – 2022	Department of Energy, Engineering and Mathematical Models, University of Palermo (Prof. Costantino Giaconia, Electronic Engineer)
2016 – 2018	Dept. of Medical Physics & Biomedical Engineering, University College London (Prof. Ilias Tachtsidis, Physicist)

3.4 Research projects funded by National and International Institutions

National Project	DOMRIBrain: Diffuse Optics and Magnetic Resonance Imaging for the Multimodal Assessment of Brain Neuronal, Hemodynamic and Metabolic activity
Agency/Body/Programme	Cascade Call Mnesys, Spoke 2
Project ID	–
Lead Partner	University “G. d’Annunzio” Chieti-Pescara
Partnership	–
Project Duration	12 months
Period	2024 – 2025
Total Cost	€ 399,987.50
Research Unit Project Cost	€ 399,987.50
Research Unit Funding	€ 399,987.50
Role	Co-Principal Investigator
Description	The DOMRIBrain project aims to integrate diffuse optical imaging and magnetic resonance imaging (MRI), acquiring both fNIRS and fast optical signals (FOS) inside the MRI scanner during calibrated BOLD-ASL fMRI recordings at rest and during a task. There are two main objectives: (i) to validate approaches for optical recording inside the MRI scanner; (ii) to investigate how the optical and MRI signals of brain activity, hemodynamics and oxygen metabolism interact over time and space, exploring the added value of the multimodal framework in understanding regional brain function and connectivity. The project includes several tasks, including: software development, optimization of the MRI acquisition protocol, in vivo recordings, and data analysis and inference.

European Project	E-MOTIVE: Empowering Mobility with affective cOmputing, brain-computer inTerface, Internet of Things, and Vital signs monitoring for Smart WhEelchairs
Agency/Body/Programme	GRANT Pharaon Horizon 2020 #857188

Project ID	S427896
Lead Partner	Next2U (Pescara, Italy)
Partnership	University “G. d’Annunzio” Chieti-Pescara, Marche Polytechnic University
Project Duration	10 months
Period	2023 – 2024
Total Cost	€ 174,976.48
Research Unit Project Cost	€ 59,625.79
Research Unit Funding	€ 59,625.79
Role	Local Unit Manager
Description	The E-MOTIVE project deals with the integration of a psychophysiological computational module with an autonomously driven wheelchair, with the aim of monitoring the individual’s affective and health state during the use of the wheelchair. In addition, the wheelchair will be equipped with a tablet for the administration of cognitive tests for monitoring users’ cognitive state. The information from the tests and from the computational module will be managed through an Internet of Things (IoT) platform.

National Project	ITINERE – Innovation for Wearable Technologies and Advanced Networks of Expert Relations
Agency/Body/Programme	MISE – Agreements for Innovation – Research and development projects in the applicative sectors consistent with the National Strategy for Intelligent Specialization (SNSI)
Project ID	F/260008/01-05/X51
Lead Partner	Proger SpA
Partnership	Proger SpA, Let’s srl, Iotron srl, ZTE Italia, University “G. d’Annunzio”
Project Duration	36 months
Period	2020 – 2023
Total Cost	€ 6,963,042.50
Research Unit Project Cost	€ 1,269,562.50
Research Unit Funding	€ 332,117.54
Role	Research activity.
Description	The ITINERE project proposes the creation of a stable research and experimentation environment among different technological components that enable the transition to the paradigms of the new 5G services in the life sciences sector, of smart fabrics with which to make smart garments capable of monitoring various physiological parameters, including HRV and respiratory rate, and to validate their use in various applicative fields such as: telemedicine, sport, and extreme work environments. The Local Research Unit of the University “G. d’Annunzio” of Chieti-Pescara develops artificial-intelligence-based algorithms for the automatic implementation of individual attention and risk thresholds and profiling, also with reference to the environmental conditions in which the subject operates, through IoT. The smart wearables are developed by Let’s srl, while the 5G architecture

	for data transmission and remote device control is implemented by ZTE. Field tests involve, among others: Italian Red Cross, ENI, Inter FC.

National Project	Development of advanced technologies and systems for car safety through ADAS+ platforms
Agency/Body/Programme	PON – MIUR – Industrial Research and Experimental Development Projects in the 12 Specialization Areas identified in the PNR 2015-2020 – Specialization area: Sustainable mobility
Project ID	ARS01_00459
Lead Partner	STMicroelectronics (Catania)
Partnership	STMicroelectronics, University of Catania, Distretto Tecnologico Sicilia Micro e Nano Sistemi scarl; INNOVAAL S.C. A R.L., INSTM – National Interuniversity Consortium for the Science and Technology of Materials, MTA spa, University "G. d'Annunzio" Chieti-Pescara, National Interuniversity Consortium for Nanoelectronics
Project Duration	42 months
Period	2018 – 2022
Total Cost	€ 9,110,200.40
Research Unit Project Cost	€ 506,000.00
Research Unit Funding	€ 253,000.00
Role	Research activity
Description	The ADAS+ project aims to develop an innovative safe-driving assistance demonstrator (ADAS+) capable of monitoring, in a timely and continuous manner, both the driver's psycho-physical state and their state of intoxication, as well as the air quality of the cabin. This is possible through the use of silicon technologies, advanced image processing algorithms and nano-structured materials integrated into a common platform that meet the safe-driving standards required for the new generation of "smart" cars. This objective was pursued through the development and integration of three advanced prototype technological modules, based on innovative technological platforms, namely: 1) a Physio Module consisting of miniaturized SiP optical probes; 2) a Vision Module consisting of (a) visible-light microcameras and (b) IR-light cameras to detect signs of tiredness or irritability; (3) a Chemical Sensors Module. The aforementioned prototype modules are integrated to create a final ADAS+ control unit demonstrator containing the ST components developed within the project. The Local Research Unit of the University "G. d'Annunzio" of Chieti-Pescara developed the algorithms and the sensing elements of the Vision module.

European Project	ASTONISH – Advancing Smart Optical Imaging and Sensing for Health
Agency/Body/Programme	H2020-EU.2.1.1.7 – ECSEL
Project ID	692470-2
Lead Partner	Philips Medical Systems (Netherlands)
Partnership	Eindhoven University of Technology, Academic Center for Epileptology ACE Kempenhaeghe, Dutch Cancer Institute, Leiden University Medical Centre,

	STMicroelectronics, CNR-IMM, University of Palermo, University "G. d'Annunzio" Chieti-Pescara, Brno University of Technology – CEITEC, IMEC, g.tec medical engineering, CSIC, Ibermatica, Tecnalia, University of Basque Country
Project Duration	36 months
Period	2016 – 2019
Total Cost	€ 18,444,623.00
Research Unit Project Cost	€ 400,000.00
Research Unit Funding	€ 240,000.00
Role	Research activity
Description	The ASTONISH project dealt with providing and developing revolutionary imaging and sensing technologies for monitoring, diagnosis and treatment applications, such as miniaturized optical components, data processing units and smart SW applications, key applications and technologies for the integration of healthcare and intelligent systems. Specifically, the Local Research Unit of the University "G. d'Annunzio" of Chieti-Pescara was responsible for participating in the design, implementation and validation of ECG-PPG and EEG-fNIRS combo systems based on SiPM sensors. In addition, the research unit was responsible for developing machine-learning- and artificial-intelligence-based algorithms for processing the data obtained from the systems in the project.

3.5 Invited lectures

- 21/10/2022, Artificial Intelligence, Machine Learning And Data Science Conference, Online, "Early Alzheimer's Disease detection through machine learning applied to neuroimaging data".
- 14/10/2022, Global Experts Meet on Applied Science, Engineering and Technology, Paris, "Machine learning approaches applied to psychophysiological signals to facilitate human-machine interactions".
- 4/10/2022, fNIRS Conference – Spotlight Session, Online, "Assessment of functional plasticity in children with cerebral palsy in response to robotic-assisted gait training".
- 14/12/2021, International E-Conference on AI and Machine Learning, Online, "Machine Learning approaches in neuroimaging for early Alzheimer's Diseases detection".

3.6 Organization of conferences and Workshops

- 6/11/2025, Organization of the special session: "Non-invasive monitoring of psychophysiological states of military personnel during operation and training" within the 2025 IEEE International Workshop on Technologies for Defense and Security, IEEE TechDefense 2025, Rome, Italy.
- 12/11/2024, Organization of the special session: "Non-invasive monitoring of psychophysiological states of military personnel during operation and training" within the 2024 IEEE International Workshop on Technologies for Defense and Security, IEEE TechDefense 2024, Naples, Italy.
- 3/7/2024, Organization of the workshop "1st International Workshop on Artificial Intelligence for Sustainable Development ARISDE 2024", a joint event of the IEEE 59th International Scientific Conference on Information, Communication and Energy Systems and Technologies (ICEST 2024).

- 5/12/2023, Organization of the workshop: “1st International Workshop on Affective Computing and Health Care: new research and industrial perspectives”, satellite event of the IEEE International Conference on Bioinformatics and Biomedicine 2023 (BIBM).
- 20/11/2023, Organization of the special session: “Non-invasive monitoring of psychophysiological states of military personnel during operation and training” within the 2023 IEEE International Workshop on Technologies for Defense and Security, IEEE TechDefense 2023, Rome, Italy.

3.7 Presentations at national and international conferences and schools

This list does not include the invited lectures at national and international congresses, already indicated in section 3.6 Invited lectures.

- 13-15/04/2026, Conference “Metodi a Confronto – international perspectives on musicological and artistic-performative research”, Cagliari (Italy), “A Multimodal Investigation of Psychophysiological and Neural Correlates of Embodied Experience in Musical Performance”.
- 26-27/01/2026, Symposium “Methodological Challenges and Perspectives in Multimodal Music Performance Research” SAMUSE 2026, Luxembourg, “Psychophysiological Monitoring of Music Performance Anxiety and Cognitive Load through Thermography and Functional Near-Infrared Spectroscopy”.
- 13-14/11/2025, 13th International Conference on E-Health and Bioengineering – EHB 2025, Iasi (Romania) – hybrid event. “Unveiling Acoustic Patterns as Digital Biomarkers of Psychosis Through Machine Learning approaches”.
- 13-14/11/2025, 13th International Conference on E-Health and Bioengineering – EHB 2025, Iasi (Romania) – hybrid event. “Long Short-Term Memory Networks for Fast Optical Signal Identification in the Human Visual Cortex for Brain Computer Interface Applications”.
- 13-14/11/2025, 13th International Conference on E-Health and Bioengineering – EHB 2025, Iasi (Romania) – hybrid event. “Explainable Transfer Learning Models for Thermal Imaging-Based Breast Cancer Classification”.
- 15-19/09/2025, International Workshop on Advanced Infrared Technology and Applications (AITA2025), Kobe (Japan). “Preliminary Insights into Thermography-Based Psychophysiological Monitoring of Musicians During Performance”.
- 16-18/06/2025, IX Congress of the National Group of Bioengineering (GNB), Palermo (PA). “Exploring the role of heat exchange during tactile human-robot interaction”.
- 14-15/11/2024, 12th International Conference on E-Health and Bioengineering – EHB 2024, Iasi (Romania) – hybrid event. “Comparative Evaluation of Psychophysiological State in Psychologists vs. Tablet-Based Administration of the Mini-Mental Test Through Thermal Imaging”.
- 14-15/11/2024, 12th International Conference on E-Health and Bioengineering – EHB 2024, Iasi (Romania) – hybrid event. “Thermal Imaging for Real-Time Monitoring of Stress and Engagement in Autonomous and Manual Smart Wheelchair Navigation”.
- 12-15/09/2024, Global fNIRS 2024, Birmingham (UK). “Assessing Visual Cognitive Motivation through Machine Learning applied to fNIRS data”.
- 6-8/09/2024, XVI Congress of the European Association of Thermology, Wrocław (Poland). “Investigation of the impact of the robotic touch temperature on human engagement during interactions with the nao robot”.
- 6-8/09/2024, XVI Congress of the European Association of Thermology, Wrocław (Poland). “Technostress detection through facial dynamic thermography”.

- 10-13/06/2024, IX European Medical and Biological Engineering Conference (EMBEC 2024), Portoroz (Slovenia). “The Prediction of Sleep Quality using Heart Rate Variability Modulations during Wakefulness”.
- 10-13/06/2024, IX European Medical and Biological Engineering Conference (EMBEC 2024), Portoroz (Slovenia). “Unveiling Age-Related Patterns in Vocal Expression of Emotions: A Machine Learning Approach with Mel and Gammatone Frequency Cepstral Coefficients”.
- 10-13/06/2024, IX European Medical and Biological Engineering Conference (EMBEC 2024), Portoroz (Slovenia). “A Machine Learning Framework for Gait and EMG Analysis for Post-Stroke Motor Dysfunctions Assessment”.
- 21-23/06/2023, VIII Congress of the National Group of Bioengineering (GNB), Padua (PD). “Driver drowsiness detection relying on infrared thermal imaging: a machine learning approach”.
- 21-23/06/2023, VIII Congress of the National Group of Bioengineering (GNB), Padua (PD). “Drivers’ mental workload assessment based on machine learning applied to multimodal physiological data”.
- 17-12/11/2022, 10th IEEE International Conference on e-Health and Bioengineering. Hybrid Event: Iasi (Romania) and Online. “A Machine Learning approach to classify driver mental workload as assessed by Electroencephalography through Infrared Thermal Imaging”.
- 23-26/10/2022, 50th SIMFER National Congress 2022 (Italian Society of Physical and Rehabilitation Medicine), Santa Tecla (CT), “Effects of a single session of functional electrical stimulation through the Mollii suit device in an ataxic patient following ponto-mesencephalic hemorrhage”.
- 23-26/10/2022, 50th SIMFER National Congress 2022 (Italian Society of Physical and Rehabilitation Medicine), Santa Tecla (CT), “Monitoring of neurophysiological activity and psychophysiological state during assistive robotic therapy in pediatric patients with infantile cerebral palsy through fNIRS and Thermography”.
- 11-12/10/2022, International Exhibition and Conference for Exoskeleton and Human Augmentation Systems, Berlin, “Neural plasticity and emotional state evaluation during RAGT on CP patients”.
- 12-14/06/2022, XXI National Congress of the Italian Society of Neurological Rehabilitation, Naples, “Monitoring of neurophysiological activity during assistive robotic therapy in pediatric patients with infantile cerebral palsy through fNIRS”.
- 26/10/2021, 16th International Workshop on Advanced Infrared Technology and Applications, Online, “Is it possible to estimate average heart rate from facial thermal imaging?”.
- 19/10/2021, SfNIRS Virtual Meeting 2021, Online, “Driver Cognitive Workload Estimation through a Supervised Machine Learning approach based on fNIRS.”.
- 11-16/09/2021, Neuroergonomics Conference 2021, Online, “Driver cognitive workload monitoring by IR imaging”.
- 1-5/08/2021, SPIE Optics + Photonics 2021, Online, “Convolutional neural network model for augmentation index prediction based on photoplethysmography”.
- 1-5/08/2021, SPIE Optics + Photonics 2021, Online, “Age-related ocular surface modifications assessment combining thermal infrared and deep learning approach.”.
- 1-5/08/2021, SPIE Optics + Photonics 2021, Online, “Driver drowsiness evaluation by means of thermal infrared imaging: Preliminary results.”.
- 29/06/2021, 3rd International Conference on Robotics and Artificial Intelligence. Online. “Enhancing child-robot interaction by means of thermal infrared imaging-based affective computing”.
- 24/11/2020, 19th Conference of the Italian Association for Artificial Intelligence, online, “Thermal infrared imaging and artificial intelligence techniques can support mild Alzheimer disease diagnosis”.

- 21-30/09/2020, 15th Quantitative Infrared Thermography Conference, online, “Automated convolutional neural network approach for discriminating systemic sclerosis on the basis of hand thermal pattern.”.
- 21-30/09/2020, 15th Quantitative Infrared Thermography Conference, online, “Thermal infrared imaging reveals that 6-12 month-old babies show different autonomic response to interaction with robot and avatar”. Extended version accepted for publication in Taylor and Francis Peer-reviewed Journals.
- 27/09/2019, fNIRS UK Congress 2019, Birmingham, “Dynamic contrast-enhanced near-infrared spectroscopy using indocyanine green on moderate and severe traumatic brain injury: an observational study”.
- 17/09/2019, 15th International Workshop on Advanced Infrared Technology and Applications, Florence, “Integrated Multi-channel PPG and ECG System for Cardiovascular Risk Assessment”.
- 24/07/2019, 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Berlin, “Wearable, Fiber-less, Multi-Channel System for Continuous Wave Functional Near Infrared Spectroscopy Based on Silicon Photomultipliers Detectors and Lock-In Amplification”.
- 06/07/2018, XIV Congress of the European Association of Thermology, London, “Assessment of autonomic response in alzehimer’s disease patients during the execution of memory tasks: a functional thermal imaging study.”.
- 06/07/2018, XIV Congress of the European Association of Thermology, London, “Modelling event-related thermal response by means of general linear model.”.
- 06/07/2018, XIV Congress of the European Association of Thermology, London, “Speed of movement during knee extension does not affect skin temperature dynamics after exercise”.
- 15/06/2018, Joint Italian-French Workshop on Cerebral oximetry and functional near infrared spectroscopy (fNIRS), Milan, “Complexity analysis of fNIRS signal for the assessment of memory impairments in Alzheimer’s disease.”.
- 07/09/2017, fNIRS UK Congress, London, “Study of frontal and prefrontal cortex oxygenation by means of fNIRS during Clock Drawing Test, Digit Span Test and Corsi Block Tapping Test in Alzheimer’s Disease”.
- 07/09/2017, fNIRS UK Congress, London, “fNIRS: new ways to identify atypical patterns of prefrontal cortex activation in autism spectrum disorder”.
- 15/10/2016, fNIRS 2016: biennial meeting of the sfNIRS, Paris, “Study of memory deficit in Alzheimer’s Disease by means of complexity analysis of fNIRS signal”.

3.8 Research positions at foreign and international universities and research institutes of high qualification

October 2016 – May 2017	Visiting Scholar at the Department of Medical Physics and Biomedical Engineering and the Institute of Cognitive Neuroscience (ICN) of University College London (UCL) (London, UK).

3.9 Review, editorial and scientific society activities

Role	**Journal**
Editorial Board Member	Frontiers in Bioengineering and Biotechnology
Special Issue Editor	“Infrared Sensing and Thermal Imaging for Biomedical Engineering” – Sensors MDPI

Special Issue Editor	“Sensors for Biomedical Imaging 2023” – Sensors MDPI
Special Issue Editor	“Infrared Sensing for Biomedical Applications” – Sensors MDPI
Special Issue Editor	“Effect of Neurophysiological Conditions and Mental Workload on Physical and Cognitive Performances: a Multidimensional Perspective” – Frontiers in Neuroergonomics
Special Issue Editor	“Affective Computing and Mental Workload Assessment to Enhance Human-Machine Interaction” – Frontiers in Neuroergonomics
Referee	Applied Sciences – MDPI
Referee	Entropy – MDPI (Member of the Reviewer Board, https://www.mdpi.com/journal/entropy/submission_reviewers)
Referee	Sensors – MDPI
Referee	Thermology International – Ludwig Boltzmann Forsch. fur Physikalishe Diagnostik
Referee	Engineering Research Express – IOP Publishing
Referee	Journal of Neural Engineering – IOP Publishing
Referee	Physiological Reports – SAGE Publishing
Referee	International Journal of Environmental Research and Public Health – MDPI
Referee	Algorithms – MDPI
Referee	Biology – MDPI
Referee	Healthcare – MDPI
Referee	IEEE Journal of Biomedical and Health Informatics – Institute of Electrical and Electronics Engineers Inc. (IEEE)
Referee	Psychological Medicine – Cambridge University Press

3.10 Awards and recognitions for scientific activity

- 15/11/2024, Last author of the paper entitled “Advancing Voice Authentication: Insights from Cepstral Coefficients and Recursive Feature Elimination in Speech Signal”, awarded first place at the young researcher competition of the 12th International Conference on e-Health and Bioengineering – EHB 2024, Online & Onsite – Iasi, Romania.
- 15/11/2024, Co-author of the paper “Machine Learning-Based Estimation of POMA Scores from EMG and Kinematic Data in Stroke Patients”, awarded an honorable mention at the young researcher competition of the 12th International Conference on e-Health and Bioengineering – EHB 2024, Online & Onsite – Iasi, Romania.
- 21/09/2024, Third place at the “Young Sport Scientist Award” with a paper entitled “Thermal Imaging Insights into the Effects of Box Squats and Pin Squats based training on Powerlifting” at the XV National Congress of the Italian Society of Motor and Sport Sciences, Chieti (Italy).
- 23/10/2020, Finalist of the “Young Investigator Competition” of the 8th European Medical and Biological Engineering Conference (the competition was cancelled due to the COVID-19 pandemic and the award was never assigned).

4. TEACHING

4.1 Courses in Degree Programmes

Since 2024	Course of Industrial Bioengineering (Module B), Bachelor's Degree Programme in Biomedical Engineering at the University "G. d'Annunzio" Chieti-Pescara. 6 CFU. SSD ING-IND/34
Since 2023	Course of Bioengineering and Biomechanics of Movement, Master's Degree Programme in Biomedical Engineering at the University "G. d'Annunzio" Chieti-Pescara. 6 CFU. SSD ING-IND/34
2022-2023	Subject Expert (Cultore della Materia) in Biomedical Signal and Data Analysis. Master's Degree Programme in Biomedical Engineering at the University "G. d'Annunzio" Chieti-Pescara. 6 CFU. SSD ING-INF/06
2022-2023	Subject Expert (Cultore della Materia) in Industrial Bioengineering. Bachelor's Degree Programme in Biomedical Engineering at the University "G. d'Annunzio" Chieti-Pescara. 12 CFU. SSD ING-IND/34
2022 – 2023	Subject Expert (Cultore della Materia) in Medical Physics. Degree Programme in Medicine. 12 CFU. FIS/07
2020 – 2021	Subject Expert (Cultore della Materia) in Applied Physics. Degree Programme in Dentistry and Dental Prosthetics at the University "G. d'Annunzio" Chieti-Pescara. 6 CFU. SSD FIS/07

4.2 Tutorials and Integrative Teaching Activities

2022-2023	Supervision of internships for the Medical Physics course in the Degree Programme in Medicine at the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy).
August 2022	Teaching activity for the preparatory Physics courses of the Degree Programmes in Medicine and Health Professions.
August 2022	Teaching activity for the preparatory Mathematics courses of the Degree Programmes in Medicine and Health Professions.
2021-2022	Supervision of internships for the Medical Physics course in the Degree Programme in Medicine at the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy).
August 2021	Teaching activity for the preparatory Mathematics courses of the Degree Programmes in Health Professions.
August 2021	Teaching activity for the preparatory Mathematics courses of the Degree Programmes in Medicine.
2020-2021	Supervision of internships for the Medical Physics course in the Degree Programme in Medicine at the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy).
2019-2020	Supervision of internships for the Medical Physics course in the Degree Programme in Medicine at the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy).
2018-2019	Supervision of internships for the Medical Physics course in the Degree Programme in Medicine at the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy).
2017-2018	Supervision of internships for the Medical Physics course in the Degree Programme in Medicine at the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy).
2015-2016	Supervision of internships for the Medical Physics course in the Degree Programme in Medicine at the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy).
2014-2015	Supervision of internships for the Medical Physics course in the Degree Programme in Medicine at the University "G. d'Annunzio" Chieti-Pescara (Chieti, Italy).

4.3 Teaching in PhD Programmes

2021-2022	Course “Thermal Infrared Imaging and functional Near-Infrared Spectroscopy” (SSD FIS/07, 8 hours). PhD in Neuroscience and Imaging, University “G. d’Annunzio” Chieti-Pescara (Chieti, Italy).
23/02/2023	Internship in Functional Near-Infrared Spectroscopy (fNIRS), within the PhD programme in Neuroscience and Imaging (4 hours). Course focused on the biomedical applications of fNIRS, University “G. d’Annunzio” Chieti-Pescara (Chieti, Italy).
8–26/02/2024	Course “New technologies for the digital transition in public health”, within the PhD programme in Digital Transition, Innovation and Health Services (8 hours), “Da Vinci” University, Torrevecchia Teatina (CH).

4.4 Mentoring and Thesis Supervision

Role	Course	Date	Thesis Title
First co-supervisor	Biomedical Engineering	09/04/2026	Assessment of cortical activity through fNIRS in children with cerebral palsy during robot-assisted gait training
First supervisor	Biomedical Engineering	09/04/2026	Application of deep learning techniques to the analysis of the Rey Complex Figure for the assessment of cognitive decline.
First supervisor	Biomedical Engineering	09/04/2026	Non-invasive diagnosis of PAD through deep learning on multichannel photoplethysmographic and electrocardiographic signals: an approach based on visual encoding and CNN
First supervisor	Biomedical Engineering	09/04/2026	Predictive model of HbA1c in diabetic patients treated with an insulin pump through Machine Learning algorithms
First supervisor	Biomedical Engineering	09/04/2026	Assessment of cortical plasticity in response to robotic gait rehabilitation in infantile cerebral palsy through fNIRS
First supervisor	Biomedical Engineering	19/02/2026	Removal of physiological contamination in fNIRS signals through Thermography and Short Channels: Effects on EEG-fNIRS coherence
First supervisor	Biomedical Engineering	19/02/2026	Machine learning analysis and classification of fast optical signals for brain computer interface applications
First supervisor	Biomedical Engineering	19/02/2026	Mind to motion: EEG classification with machine learning for prosthetic actuation
First co-supervisor	Biomedical Engineering	16/10/2025	Analysis of psychophysiological responses during cognitive tests: comparison between administration by a psychologist and an artificial agent
First supervisor	Biomedical Engineering	16/10/2025	Study of brain plasticity through fNIRS in robot-assisted gait rehabilitation in children with infantile cerebral palsy
First supervisor	Biomedical Engineering	16/10/2025	Monitoring of cognitive load in flight pilots through fNIRS: development of a machine-learning-based predictive system
First co-supervisor	Biomedical Engineering	16/10/2025	Development and validation of an autoencoder-based compression method for dermoscopic images
First supervisor	Biomedical Engineering	16/10/2025	Development of Machine Learning Models for the Prediction of Alzheimer’s Disease from Handwriting Trait Analysis.
First supervisor	Biomedical Engineering	24/07/2025	Implementation of an artificial intelligence system for the recognition of vocal patterns in the early diagnosis of Alzheimer’s
First supervisor	Biomedical Engineering	24/07/2025	Post-stroke rehabilitation robotics with Armeo Power: assessment of acute and subacute effects on fNIRS, HRV and thermography biomarkers.

First supervisor	Biomedical Engineering	24/07/2025	Development of an Interactive 3D Model of the Heart for the Visualization of Cardiac Data.
First supervisor	Biomedical Engineering	24/07/2025	Development and Optimization of Artificial Intelligence Models for the Differential Diagnosis of Breast and Thyroid Tumors from Thermographic Images
First supervisor	Biomedical Engineering	24/07/2025	Automatic classification of neurological pathologies from MRI images through Deep Learning: comparison between CNN architectures and model optimization
First supervisor	Biomedical Engineering	24/07/2025	Multimodal assessment of the effect of attentional focus on postural control
First supervisor	Biomedical Engineering	24/07/2025	Multimodal Imaging for the Early Diagnosis of Alzheimer's: an integrated investigation with fNIRS, EEG and thermography
First supervisor	Biomedical Engineering	24/07/2025	Integrated Assessment of the Acute Effects of French Press Training: An Investigation with Thermographic, Electromyographic and fNIRS Techniques
First supervisor	MSc Biomedical Engineering	24/07/2025	Toward Predictive Biomarkers of Freezing-of-Gait: An End-to-End fNIRS Signal-Processing Framework in Parkinson's Disease
First supervisor	Biomedical Engineering	24/07/2025	Analysis of Visual Behavior in Children with Autism Spectrum Disorder: An Approach Based on Eye-Tracking and Machine Learning
Second co-supervisor	MSc Medicine and Surgery	29/01/2025	Assessment of the impact of psoriatic disease in patients and in the general population through the use of artificial intelligence
First co-supervisor	Biomedical Engineering	18/10/2024	Identification of papillary carcinoma and benign follicular adenoma of the thyroid through thermal imaging
First co-supervisor	Biomedical Engineering	26/07/2024	Development of new fNIRS signal analysis techniques for the assessment of neuronal plasticity in the context of pediatric rehabilitation robotics.
First co-supervisor	Biomedical Engineering	26/07/2024	Near-infrared spectroscopy in cognitive and motor rehabilitation: a study of clinical applications.
First supervisor	MSc Biomedical Engineering	26/07/2024	Extraction of Classical and Entropy Metrics from Kinematic and EMG Signals for the Machine-Learning-Based Identification of Stroke Motor Impairments
First co-supervisor	MSc Biomedical Engineering	26/07/2024	Voice-Based Diagnostic Techniques and AI: New Possibilities for Ubiquitous Diagnosis
First supervisor	MSc Biomedical Engineering	26/07/2024	Thermographic and electromyographic assessment of the effects of box squat and pin squat based training on powerlifting performance
First co-supervisor	Biomedical Engineering	26/07/2024	Use of near-infrared spectroscopy in rehabilitation: assessment of neuronal plasticity in children with cerebral palsy
First co-supervisor	Biomedical Engineering	23/02/2024	Assessment of cognitive load in the automotive field through thermal infrared imaging
First co-supervisor	Biomedical Engineering	13/10/2023	Wearable devices for heart rate monitoring: a comparison between new wearable technologies

5. THIRD MISSION

Since 2018	Participation in the European Researchers' Night, University "G. d'Annunzio" of Chieti-Pescara.

6. SCIENTIFIC PUBLICATIONS

6.1 Information on overall scientific output

Volume of Overall Scientific Output on Scopus (updated to 29/06/2026)

Total Number of Publications	106
Total number of peer-reviewed publications	106
Period in which the output was produced	From 2018 to 2026
h-index	24
Citations	1497

Intensity of Overall Scientific Output

Average publications per year	11.8
Average citations per year	166.3
Period in which the output was produced	From 2018 to 2026

Continuity of Overall Scientific Output

Number of continuous years of output in the period	9
Period in which the output was produced	From 2018 to 2026

6.2 Articles published in international peer-reviewed journals

1) Liang, F., Qiao, Y., Perpetuini, D., & Ho, H. (2026). Diagnostic and predictive roles of computational cardiovascular hemodynamics in the management of cardiovascular diseases. Frontiers in Bioengineering and Biotechnology, 14, 1804586.
2) Di Plinio, S., Menardo, E., Greco, C., Cardone, D., Perpetuini, D., Merla, A., ... & Ebisch, S. (2026). Effect of Natural and Artificial Surroundings on Perceived Restorativeness and Affective States: Evidence from a Satellite Image Segmentation-based Method. Journal of Environmental Psychology, 102973.
3) De Giacomo, A., Palmieri, R., Russo, E. F., Pizzolorusso, I., Brandi, R., Magistro, F., ..., Perpetuini D., & Merla, A. Machine Learning and Deep Learning applied to EEG and fNIRS for Early Autism Spectrum Disorder Diagnosis: A Systematic Review. Frontiers in Psychiatry, 17, 1668914.
4) Cerritelli, F., Perpetuini, D., Keys, J., Merla, A., & Cardone, D. (2025). Autonomic correlates of osteopathic manipulative treatment on facial functional mapping: an innovative approach based on thermal imaging. Scientific Reports, 15(1), 7373. DOI: 10.1038/s41598-025-92092-8
5) Filoni, S., Romano, F., Cardone, D., Palmieri, R., Forte, A., Di Iorio, A., Russo E.F., Perpetuini D., & Merla, A. (2025). Acute and Subacute Effects of Session with the EXOPULSE Mollii Suit in a Multiple Sclerosis Patient: A Case Report. Bioengineering, 12(9), 994. DOI: 10.3390/bioengineering12090994
6) Pellegrino, R., Perpetuini, D., Paganelli, R., Di Iorio, A., Filoni, S., Tinari, N., ... & Ferrucci, L. (2025). Galectin-3-binding protein is a risk factor for Diabetes, Metabolic Syndrome, and Inflammation. Cross-sectional and Longitudinal Results from the InCHIANTI study. Mechanisms of Ageing and Development, 112086. DOI: 10.1016/j.mad.2025.112086

1) Smeesters, L., Venturini, F., Paulus, S., Mahlein, A. K., Perpetuini, D., Cardone, D., ... & Mignani, A. G. (2025). 2025 photonics for agrifood roadmap: towards a sustainable and healthier planet. Journal of Physics: Photonics, 7(3), 032501. DOI: 10.1088/2515-7647/adbea9

2) Baio, R., Molisso, G., Perpetuini, D., Battista, E., Di Mauro, U., Intilla, O., ... & Sanseverino, R. (2025). Eternal dilemma between percutaneous nephrostomy and double J stenting in the management of patients with ureteral obstruction: A single center study. Biomedical Reports, 23(1), 108. DOI: 10.3892/br.2025.1986

3) Llana, T., Perpetuini, D., Zorzo, C., & Mendez, M. (2025). Exploring the Neural Correlates of Visuospatial Memory: A Comprehensive Review of Brain Activity Assessment in Immersive Virtual Reality Research During the Last Decade. Applied Sciences, 15(4), 1881. DOI: 10.3390/app15041881

4) Forcione, M., Chiarelli, A. M., Perpetuini, D., Perkins, G. A., Stevens, A. R., Davies, D. J., & Belli, A. (2025). Diffuse optical tomography system for acute traumatic brain injury in the intensive care unit: a prospective study on healthy volunteers. Journal of Biomedical Optics, 30(S2), S23912-S23912. DOI: 10.1117/1.JBO.30.S2.S23912

5) Formenti, D., Merla, A., & Perpetuini, D. (2025). Infrared Thermography: A Possible Role in Psychophysiology of Sports?. In Application of Infrared Thermography in Sports Science (pp. 365-393). Cham: Springer Nature Switzerland.

6) Formenti, D., Perpetuini, D., Merla, A., & Priego-Quesada, J. I. (2025). The use of infrared thermography in the study of sport and exercise physiology. In Application of infrared thermography in sports science (pp. 185-212). Cham: Springer Nature Switzerland.

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