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TIZIANA CATTAI

Curriculum Vitae

Part I – General Information

Full Name	Tiziana Cattai
Date of Birth	
Place of Birth	
Citizenship	
Permanent Address	
Mobile Phone Number	
E-mail	
Spoken Languages	Italian, English, French

Part II – Education

Type	Year	Institution	Notes (Degree, Experience...)
University graduation	2017	Sapienza University of Rome	Master Degree in Biomedical Engineering. Final grades: 110/110 cum laude
University graduation	2015	Sapienza University of Rome	Bachelor Degree in Clinical Engineering. Final grades: 110/110 cum laude
PhD	2021	Joint PhD between Sorbonne Université (Paris, France) and Sapienza University of Rome (Italy)	PhD course: Information and Communication Technology. Final Grades: OTTIMO

Part III – Appointments

IIIA – Academic Appointments

Start	End	Institution	Position
1/03/2022	Today	Sapienza University of Rome	Postdoctoral Researcher (assegnista di ricerca vincitore di concorso Legge 240/2010)
9/02/2022	28/02/2022	Sapienza University of Rome	Postdoctoral Researcher (borsa di studio senior)

1/04/2021	30/09/2021	INSERM (Institut national de Santé et Recherche Medical) + ICM (Institut du Cerveau et de la Moelle Epiniere), Paris, France	Postdoctoral researcher
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IIIB – Other Appointments

Period	Institution	Position
04/2022-09/2022	Aenduo s.r.l.	Collaboration for research activity in SAFE-MATE-ECG (Silent Atrial Fibrillation ECG Monitor with Artificial intelligence) project. POR FESR LAZIO 2014/2020 - REGIONE LAZIO

Part IV – Teaching experience

Year	Institution	Lecture/Course
2022	Sapienza University of Rome	Teacher of the course: "Probabilità e Statistica" (32 hours) in the Master of "Servizi logistici e di comunicazione per sistemi complessi" at DIET dept.
2022	Sapienza University of Rome	Lecture “UAV-assisted eXtended reality services in 5G/6G networks” in PhD school Artificial Intelligence for Urban Air Mobility (AI4UAM) at DIAG dept. https://ai4uam.bubbles-project.eu/
2022	WiNK	Teacher of IoT courses (12 hours), title: “Internet of things”
2022	WiNK	Teacher of data Visualization courses (3hours) title: “data visualization”
2019	Sorbonne Université	Teacher of the course “projet informatique” code E6-IPC (30 hours)

Part V - Society memberships, Awards and Honors

Year	Title
2023	IEEE society and IEEE Women in Engineering
2017	“Borsa Ventura per Tesi all’Estero” https://www.fondazioneapienza.uniroma1.it/node/166

Part VI - Funding Information [grants as PI-principal investigator or I-investigator]

Year	Title	Program	Grant value
2022	Multilayer network modeling of brain signals for functional	PI Avvio alla Ricerca – Tipo 2	3.328 €

	connectivity estimation		
2022	Towards eXtended reality services in 6G VLC networks	I Progetti di Ricerca (Piccoli, Medi) - Progetti Medi	10.000 €
2020	Signal processing on networked data: from extended reality filtering to biological network learning	I Progetti di Ricerca (Piccoli, Medi) - Progetti Medi	13.000 €
2019	Exploiter le réseau de connectivité du cerveau pour détecter les états mentaux pendant l'imagerie motrice".	PI Bando Vinci Università Italo Francese	5.570 €
2019	IoT networks for 5G smart health applications	I IoT networks for 5G smart health applications	15.000 €
2018	Time-varying connectivity estimation for online Brain Computer Interface	PI Avvio alla Ricerca - Tipo 1	1.000 €

Part VII – Research Activities

Keywords

Signal Processing
Graph Processing
Point Cloud
Real data analysis

Brief Description

The research activity of Tiziana Cattai has generally focused on signal processing applied on interacting domains. We are surrounded by networked data, that are intrinsically connected. Her research aims to investigate original theoretical tools to process networked data, usually modeled with graphs, defined on Euclidean and non-Euclidean spaces and to adapt them on advanced problems related to information theory.

One of the main aspects characterizing her research is the attention and the application of real data.

In this direction, she has experience in recording real data, in the specific framework of a US-French project NETBCI, where 40 healthy subjects were involved to perform motor imagery (MI)-based brain-computer interface (BCI) experiments. During the experiments, EEG and MEG activity were recorded and Tiziana Cattai helped in the EEG set up and measurement. Those signals were recorded at ICM (Institut du Cerveau et de la Moelle Epiniere), during her PhD activity.

The investigation of real data has required the development of pre-processing algorithms. During her activity, she has applied classical detrending and Independent Component Analysis (ICA) to real data, specifically EEG signals.

Besides, she developed a novel method to denoise graph estimates to improve the detection of different connectivity states. Specifically, she has proposed a graph signal processing-based denoising algorithm that acts on the graph Laplacian by selecting suitable Laplacian eigenvectors. This algorithm directly applies on the estimated graph links and node degrees.

From a processing point of view, during her research activity, she has derived a novel formulation of the classical Jensen divergence for the denoised Laplacian measured under different states. The original expression of the Jensen divergence enables the quantification of the distance between the networks estimated under two conditions, i.e., in the motor imagery and resting state. The proposed approach was applied to denoise brain graphs obtained from real EEG data acquired in MI-BCI experiments.

Tiziana Cattai contributed to the development of a novel version of LI-Principal Component Analysis (LI-PCA) which consists in a layered version of LI-PCA, called Deep LI-PCA. It is computed by recursive application of two steps, that are the estimation of LI-PCA and computation of the first rank projector. The potential of this tool consists in its ability to identify relevant components in data corrupted by noise, outliers, or other kind of perturbations. The Deep LI-PCA has been applied on real EEG data, belonging to private and public databased and it has showed its potential to extract stable components and changes in real data with a temporal variability.

She has applied machine learning to real EEG data in order to detect human mental states, during difficult tasks such as motor imagery. She also integrated the Deep LI-PCA in a classification framework in order to shorten the time-windows necessary to give a visual feedback to the BCI user and to have more robust features for the classifier.

Tiziana Cattai's research activity has also focused on denoising and filtering on point clouds (PCs), that are the representation of 3D objects typically used for eXtended Reality (XR) applications.

During her work, she has introduced an original class of filters on PCs, the Radial Angular Filters, taking inspiration by the characteristics of the human visual system (HVS). Those functions are built to detect radial and angular behaviors on the PC, and they represent a powerful processing tool to capture relevant features on PCs.

These kinds of filter have been also used to develop a denoising algorithm, the VISually driven Point cloud Denoising Algorithm (VIPDA). This method uses recent approaches based on local harmonic angular filters that extends image processing tools to the PCs. More specifically, VIPDA applies a harmonic angular analysis of the PC geometry to associate each node of the PC to a set of neighbors and to apply the denoising according to the local PC variability.

Besides these studies, she did a strong work in writing literary survey in order to help the biomedical community to collect the literature on the subjects of machine learning and deep learning and on networks and functional connectivity.

Taken together, all the research activity of Tiziana Cattai is based on signal processing, machine learning and graph theories and it is developed in the direction of real-life applications.

Part VIII – Summary of Scientific Achievements

Product type	Number	Notes	Start	End
Papers	10	Database: Scopus	2018	2022
Invited seminars	1	EPFL (École polytechnique fédérale de Lausanne) seminar, title: GSP models and methods for biological networks	2022	2022

Oral presentations at international conferences, workshops, and Symposia

Total Impact factor	32.84
Average Impact factor (per publications)	5.473 (normalized per publications with IF>0, that are 6)
Total Citations	61 (Scopus)
Average Citations per Product	6.1 (Scopus)
Hirsch (H) index	4 (Scopus)
Normalized H index*	0.8 (H index/ academic seniority= 4/5)

*H index divided by the academic seniority.

Part IX- Organization and Participation to national and international conferences

- **Student Session co-chair** of 11th European workshop on Visual Information Processing (EUVIP 2023) <https://www.euvip2023.org/index.php/committees/organizing-committee/>
- **Presenting author of the following conferences:**
 - EUSIPCO (European signal processing conference) 2022, Belgrade, Serbia
 - GTTI (Gruppo italiano di telecomunicazioni) 2022, Padua, Italy
 - EUSIPCO (European signal processing conference) 2019, A Coruna, Spain
 - GRAZ BCI Conference, 2019, Graz, Austria
 - OHBM (Organization of human brain mapping), 2019, Rome, Italy
 - workshop Journées CORTICO, 2019, Lille, France
 - Graph Signal Processing Workshop, 2019, Paris, France
 - EUSIPCO (European signal processing conference) 2018, Rome, Italy
 - CuttingEEG conference, 2018, Paris, France.

Part X- Editorial Activity

I have been editorial reviewer for several international journals: IEEE transactions on Signal and Information Processing over Networks, IEEE Transactions on Neural Systems & Rehabilitation Engineering, PLOS ONE, Chemosphere, Brain Multiphysics.

Part XI– Selected Publications

List of the publications selected for the evaluation. For each publication report title, authors, reference data, journal IF (if applicable), citations, press/media release (if any).

Number	Type of publication	Title, authors, data	Journal IF	Citations (Scopus)
1	Journal	Cattai, T., Delfino, A., Scarano, G., & Colonnese, S. (2022). VIPDA: a Visually driven Point cloud Denoising Algorithm based on anisotropic point cloud filtering. <i>Frontiers in Signal Processing</i> , 2, 842570.	-	0

2	Conference proceedings	Cattai, T. , Beghdadi, A., Scarano, G., & Colonnese, S. (2022, September). Visually relevant point clouds features extraction by Radial Angular Point cloud filtering. In <i>2022 10th European Workshop on Visual Information Processing (EUVIP)</i> (pp. 1-5). IEEE.	-	0
3	Conference proceedings	Cattai, T. , Scarano, G., Corsi, M. C., Fallani, F. D. V., & Colonnese, S. (2022, August). EEG as Signal on Graph: a Multilayer Network model for BCI applications. In <i>2022 30th European Signal Processing Conference (EUSIPCO)</i> (pp. 932-936). IEEE.	-	0
4	Journal	Gonzalez-Astudillo, J., Cattai, T. , Bassignana, G., Corsi, M. C., & Fallani, F. D. V. (2021). Network-based brain-computer interfaces: principles and applications. <i>Journal of neural engineering</i> , <i>18</i> (1), 011001.	5.043	8
5	Journal	Cattai, T. , Scarano, G., Corsi, M. C., Bassett, D. S., Fallani, F. D. V., & Colonnese, S. (2021). Improving J-divergence of brain connectivity states by graph Laplacian denoising. <i>IEEE transactions on Signal and Information Processing over Networks</i> , <i>7</i> , 493-508.	3.301	2
6	Journal	Cattai, T. , Colonnese, S., Corsi, M. C., Bassett, D. S., Scarano, G., & Fallani, F. D. V. (2021). Phase/amplitude synchronization of brain signals during motor imagery BCI tasks. <i>IEEE Transactions on Neural Systems and Rehabilitation Engineering</i> , <i>29</i> , 1168-1177.	4.528	9
7	Journal	Ansart, M., Epelbaum, S., Bassignana, G., Bône, A., Bottani, S., Cattai, T. , ... & Durrleman, S. (2021). Predicting the progression of mild cognitive impairment using machine learning: A systematic, quantitative and critical review. <i>Medical Image Analysis</i> , <i>67</i> , 101848.	13.828	26
8	Journal	Colonnese, S., Di Lorenzo, P., Cattai, T. , Scarano, G., & Fallani, F. D. V. (2020). A joint Markov model for communities, connectivity and signals defined over graphs. <i>IEEE Signal Processing Letters</i> , <i>27</i> , 1160-1164.	3.109	4
9	Conference Proceedings	Orrú, G., Cattai, T. , Colonnese, S., Scarano, G., Fallani, F. D. V., Markopoulos, P., & Pados, D. (2019, September). Deep LI-PCA of time-variant data with application to brain connectivity measurements. In <i>2019 27th European Signal Processing Conference (EUSIPCO)</i> (pp. 1-5). IEEE.	-	2

10	Conference Proceedings	Cattai, T. , Colonnese, S., Corsi, M. C., Bassett, D. S., Scarano, G., & Fallani, F. D. V. (2018, September). Characterization of mental states through node connectivity between brain signals. In <i>2018 26th European Signal Processing Conference (EUSIPCO)</i> (pp. 1377-1381). IEEE.	-	6
11	Journal	Colonnese, S., Biagi, M., Cattai, T. , Cusani, R., De Vico Fallani, F., & Scarano, G. (2018). Green compressive sampling reconstruction in IoT networks. <i>Sensors</i> , <i>18</i> (8), 2735.	3.031	4
12	PhD thesis	T.Cattai , Leveraging brain connectivity networks to detect mental states during motor imagery	-	0

Part IX - Complete list of publications

- 1) **Cattai, T.**, Delfino, A., Scarano, G., & Colonnese, S. (2022). VIPDA: a Visually driven Point cloud Denoising Algorithm based on anisotropic point cloud filtering. *Frontiers in Signal Processing*, *2*, 842570
- 2) **Cattai, T.**, Beghdadi, A., Scarano, G., & Colonnese, S. (2022, September). Visually relevant point clouds features extraction by Radial Angular Point cloud filtering. In *2022 10th European Workshop on Visual Information Processing (EUVIP)* (pp. 1-5). IEEE.
- 3) **Cattai, T.**, Scarano, G., Corsi, M. C., Fallani, F. D. V., & Colonnese, S. (2022, August). EEG as Signal on Graph: a Multilayer Network model for BCI applications. In *2022 30th European Signal Processing Conference (EUSIPCO)* (pp. 932-936). IEEE.
- 4) **Cattai, T.**, Scarano, G., Corsi, M. C., Bassett, D. S., Fallani, F. D. V., & Colonnese, S. (2021). Improving J-divergence of brain connectivity states by graph Laplacian denoising. *IEEE transactions on Signal and Information Processing over Networks*, *7*, 493-508.
- 5) **Cattai, T.**, Colonnese, S., Corsi, M. C., Bassett, D. S., Scarano, G., & Fallani, F. D. V. (2021). Phase/amplitude synchronization of brain signals during motor imagery BCI tasks. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, *29*, 1168-1177.
- 6) Gonzalez-Astudillo, J., **Cattai, T.**, Bassignana, G., Corsi, M. C., & Fallani, F. D. V. (2021). Network-based brain-computer interfaces: principles and applications. *Journal of neural engineering*, *18*(1), 011001
- 7) Ansart, M., Epelbaum, S., Bassignana, G., Bône, A., Bottani, S., **Cattai, T.**, ... & Durrleman, S. (2021). Predicting the progression of mild cognitive impairment using machine learning: A systematic, quantitative and critical review. *Medical Image Analysis*, *67*, 101848.
- 8) Colonnese, S., Di Lorenzo, P., **Cattai, T.**, Scarano, G., & Fallani, F. D. V. (2020). A joint Markov model for communities, connectivity and signals defined over graphs. *IEEE Signal Processing Letters*, *27*, 1160-1164
- 9) Orrú, G., **Cattai, T.**, Colonnese, S., Scarano, G., Fallani, F. D. V., Markopoulos, P., & Pados, D. (2019, September). Deep LI-PCA of time-variant data with application to brain connectivity measurements. In *2019 27th European Signal Processing Conference (EUSIPCO)* (pp. 1-5). IEEE

- 10) **Cattai, T.**, Colonnese, S., Corsi, M. C., Bassett, D., Scarano, G., & de Vico Fallani, F. (2019, September). Combination of connectivity and spectral features for motor-imagery BCI. In *GRAZ BCI conference 2019*.
- 11) **Cattai, T.**, Colonnese, S., Corsi, M. C., Bassett, D. S., Scarano, G., & Fallani, F. D. V. (2018, September). Characterization of mental states through node connectivity between brain signals. In *2018 26th European Signal Processing Conference (EUSIPCO)* (pp. 1377-1381). IEEE
- 12) Colonnese, S., Biagi, M., **Cattai, T.**, Cusani, R., De Vico Fallani, F., & Scarano, G. (2018). Green compressive sampling reconstruction in IoT networks. *Sensors*, *18*(8), 2735

Autorizzo il trattamento dei miei dati personali contenuti nel mio cv ai sensi del Decreto Legislativo 30 giugno 2003, n. 196 "Codice in materia di protezione dei dati personali" e dell'articolo dell'art. 13 GDPR 679/16 - "Regolamento europeo sulla protezione dei dati personali".

Roma, 03/02/2023