Curriculum Vitae

Prof. Luca Mainardi, PhD

April 15, 2018

1 Summary

Luca Mainardi received the Master Degree (Italian *Laurea*) in Electronic Engineering from the Politecnico di Milano, Italy in 1990 and the Doctorate Degree (PhD) in Biomedical Engineering in 1997 from the same University.

Academic record & Responsabilities In 2001 he joint Politecnico di Milano as Assistant Professor and he is actually with the *Dipartimento di Elettronica, Informazione e Bioingegneria* as Associate Professor. Since 1999 he is teaching *Biomedical Signals Processing Laboratory*, a course of the Master Degree in Biomedical Engineering and *Bioelectromagnetism*, a course of the Bachelor Degree in Biomedical Engineering. He is member of the Board of the PhD track in Bioengineering and the Vice-Coordinator of the Biomedical Engineering Study Tracks (CCS). Among the founders of the *Laboratory of Advanced Radiological Analysis (LARA)*, a joint–initiative between Politecnico di Milano and the National Cancer Institute of Milan, he is currently the Co-chair of the *SPiNlabS Laboratory* at Politecnico di Milano.

Research Activity & Publication record. His research activity is in the field of biomedical signal and image processing, and biomedical system modelling with applications to the cardiovascular system. He studies and develops methods for time-frequency analysis, recursive parametric identification and non-linear analysis of cardiovascular signals and series, with interest in the investigation of Atrial Fibrillation. He also studies advanced biomedical image processing techniques for features extraction, image registration and Radiomics for oncology applications. He is author of 128 peer reviewed papers on international journals and more than 160 conference papers. He authored 18 book chapters and 2 books (one in Italian): editor of the book *Understanding Atrial Fibrillation: the signal processing Contribute* published by Morgan & Claypool, USA. He was co-editor of the Special Issue *Processing and Interpretation of Cardiac Signal during Atrial Fibrillation* of the IEEE-EMB Magazine (2006) and co-editor of the Focus Issue on *Biosignal interpretation I. Advanced methods for studying cardiovascular and respiratory systems* of Methods Information in Medicine (2014). *Scopus h–index*: 25; *Scholar h–index*: 34.

Research Grants & Funds. Since 2001, he has been the PI of several industrial and institutional Research grants. Currently, he is the Coordinator of the EU Marie-Curie project *MY-ATRIA:MultidisciplinarY training network for ATrial fibRillation monItoring, treAtment and progression* (2017–2012) under the H2020 program framework (GA-766082) and the PI of Politecnico Unit in the EU project *BD2Decide: Big Data and models for personalized Head and Neck Cancer Decision support* (2016-2019) (GA-689715).

Scientific & Editorial Boards. He is member of the Editorial Board of the journal *Biomedical Engineering - Biomedizinische Technik* (deGruyter) and member of the International Advisory Board of the Journal *Physiological Measurements* (IOPScience). Member of the Directory Board of the Italian National Group of Bioengineering (GNB) in the period 2004–2007, he was elected Chair of the International Medical Informatics Association (IMIA) WG7 on Biomedical Pattern Recognition for two terms (2010-2017); He is currently the Chair of the EMBS *Technical Committee on Biomedical Signal Processing* and member of the Board of *Computing in Cardiology* (CinC) annual Conference.

2 Detailed Curriculum

Anagraphic

Name/Surname	Luca Mainardi
Date of Birth	October 2nd, 1965
Tax ID	MNRLCU65R02D869B
Home Address	via Dante 99, 21054 Fagnano Olona (VA), Italy
e-mail	luca.mainardi@polimi.it

Bibliographic Indexes

Scopus

Documents	244
Citations	2493
h-index	25
Scopus	`https://www.scopus.com/authid/detail.uri?authorId=` `7007078486`

Scholar

Citations	6085 − 2765 (All − Since 2013)
h-index	34 − 24
i10-index	100 − 52
Scholar	`https://scholar.google.it/citations?user=-4sUeToAAAAJ&` `hl=en`

Education

11/1884–12/1990	Master (*Laurea*) Degree in Electronic Engineering, Politecnico di Milano, Italy
04/1994–04/1997	PhD Degree in Biomedical Engineering, Politecnico di Milano. Thesis title: *Multivariate Models for the study of the dynamic interactions of cardiovascular control mechanisms.*

Academic Carrier

Temporary position

05/1991–03/1994   Research Grant by Cardioline Remco Italia s.p.a.

12/1998–02/2001   Research Affiliate (*Assegno di Ricerca*), Department of Bio-engineering, Politenico di Milano.

Permanent position

03/2001–12/2010   Assistant Professor, Department of Bioengineering, Politenico di Milano.

03/2010–. . .   Associate Professor, Department of Bioengineering, Politenico di Milano.

Academic Teaching

Master Degree - Engineering School

2000–2001   *Bioelectromagnetism*, Laurea Degree in Biomedical Engineering, Politecnico di Milano.

1999–2004   *Biomedical Signal and Data Processing III*, Master Degree in Biomedical Engineering, Politecnico di Milano.(5 editions).

2004–. . .   *Biomedical Signal Processing Laboratory*, Master Degree in Biomedical Engineering, Politecnico di Milano.(14 editions).

Master Degree - Animal Science School

2014–. . .   *Biostatistic and Bioinformatics*, Master Degree in Science and Technology for Animal Production, University of Milan. (4 editions).

Bachelor Degree - Engineering School

2006–2010   *Bioelectricity and Biomagnetism*, Bachelor Degree in Biomedical Engineering, Politecnico di Milano.(4 editions).

2010–. . .   *Bioelectromagnetism*, Bachelor Degree in Biomedical Engineering, Politecnico di Milano. (8 editions).

Bachelor Degree - School of Medicine

2008–2013   *Technologies in Radiology for imaging and radiotherapy*, Bachelor Degree in Technology for Radiolgy, University of Milano. (8 editions).

Phd School - Engineering School

2002–2014   Among the Lecturers of the course *Advanced Biomedical Signal and Data Processing*, Bioengineering PhD Track, Politecnico di Milano.

2016–2017   *Biosignal Processing 4 All: Applications in Affectice–Computing, Biometric and Neuromarketing*, PhD School Course, Politecnico di Milano.

Miscellaneous

06/1994   Course on *Elettronica Biomedica* (Biomedical electronics) founded by the European Social Fund at Istituto Professionale Industria e Artigianato di Alghero (SS).

03/1995   Course on *Elaborazione Segnali Biomedicali* (Biomedical signal processing) founded by the European Social Fund at Istituto Professionale Industria e Artigianato di Alghero (SS).

05/1996   Course on *Elaborazione Numerica del segnale informativo* (Digital signal processing) founded by the European Union and Sardegna Region at Istituto Professionale Industria e Artigianato di Alghero (SS).

Thesis & PhDs

1994–. . .   He has been Tutor/Co–Tutor of more than 70 Master Thesis in Biomedical Engineering.

2001–. . .   He has been the Scientific Advisor of 9 PhD Thesis in Biomedical Engineering. (Dr. Stefano Scotti, Dr. Katia Passera, Dr. Valentina Corino, Dr. Maria Ida Iacono, Dr. Eros Montin, Dr. Bernardo dal Seno, Dr. Michele Orini, Dr. Francesco Onorati, Dr. Luca Iozzia). He is currently supervising 2 PhDs students (Eng. Marco Bologna, Eng. Rita Laureanti).

Organization Responsibility, Committees & Board

International

2003–2017   Elected Chair of the International Medical Informatics Association (IMIA) WG7 on *Biomedical Pattern Recognition*.

2016–2017   Vice-Chair of the IEEE-EMBS Technical Committee on Biomedical Signal Processing.

2018–2019   *Chair* of the IEEE-EMBS Technical Committee on Biomedical Signal Processing.

National

2005–2007   Elected Member of the Directory Board of Italian National Group of Bioengineering (GNB).

University Committees, Board & Responsibility

2003–2005   Responsible for the Study Plan of the Bachelor Degree in Biomedical Engineering at Politecnico di Milano.

2004–2007   Member of the Scientific Committee of the Department of Bioengineering of the Politecnico di Milano.

2007–2009   Member of the Board (*Giunta*) of the Department of Bioengineering of the Politecnico di Milano.

2009–2012   Scientific Responsible of Politecncio of the research convention with the National Cancer Institute of Milan.

2012–2015   Member of the Board (*Giunta*) of the Department of Electronics, Information and Bioengineering of the Politecnico di Milano.

2001–...   Promoter of the Erasmus Exchange between Politecnico di Milano and: a) Universitè de Rennes I, Rennes, France; b) Universidad de Zaragoza, Spain.

2004–...   Responsible for the Study Plan of the Master Degree in Biomedical Engineering at Politecnico di Milano.

2012–...   Member of the Board of the PhD Track in Biomedical Engineering at Politecnico di Milano.

2015–...   Member of the Didactic Board (*Giunta per la Didattica*) of the Department of Electronics, Information and Bioengineering of the Politecnico di Milano.

2016–2018   Vice–Coordinator of the Biomedical Engineering Study Track at POlitecnico di Milano.

University Labs

2002–2011   Responsible of the *Biomedical Signal, Data and Image Processing* Laboratory, Politecnico di Milano.

2004–2015   Founder and Member of the Board of the *Laboratory of Advanced Radiological Analysis* (LARA), a Joint–initiative between the National Cancer Institute of Milano and Politecnico di Milano.

2016–...   Founder and Co-Chair of the *SINlabS* at Politecnico di Milano.

Others

2002–2004   Member of the Commission for the National State Italian Qualification in the Engineering.

Editor

Editorial Board

2013–...	Member of the Editorial Board of *Biomedical Engineering / Biomedizinische Technik* (Walter de Gruyter GmbH & Co. Publisher).
2015–...	Member of the International Advisory Board of *Physiological Measurements* (IOP Publishing).

Books

2008	*Understanding Atrial Fibrillation: The Signal Processing Contribute*, L. Mainardi, L. Sornmo, S. Cerutti Eds, Morgan&Claypool, USA.
2011	(in Italian) *Principi di Bioelettricità e Bioelettromagnetismo*, L. Mainardi and P. Ravazzani, Patron Editore, Bologna, Italy.

Journal Special Issues

11/2006	*Processing and Interpretation of Cardiac Signal during Atrial Fibrillation* Special Issue of the $EMBS$ Magazine in Medicine and Biology (Issue 8, Nov/Dec 2006).
11/2014	*Biosignal interpretation I. Advanced methods for studying cardiovascular and respiratory systems*, Focus Issue of Methods of Information in Medicine (Issue 4, 2014).

Research Grants

Principal Investigator - [European Union Projects]

2016-2019	PI, Politecnico Unit, EU project, call: H2020–PHC–2015, GA #689715, *BD2Decide: Big Data and models for personalized Head and Neck Cancer Decision support.*
2016-2021	Coordinator of the Marie-Curie Action, call: H2020–MSCA–ITN–2017, GA #766082, *MultidisciplinarY training network for ATrial fibRillation monItoring, treAtment and progression*

Principal Investigator - [Institutional Research Grants]

2001–2002	Principal Investigator of National Research Council founding #CNRG00F3F1 *Methods for the analysis of endocavitary signals for the detection and classification of atrial fibrillation episodes and for the planning of antiarrhythmic therapy.*
2006	Research grant by IRCCS Fondazione C. Mondino, Pavia.

2010–2013   Research funding by National Cancer Institute of Milano, Italy

2013–2015   Research grant: *Metodi innovativi per la caratterizzazione di zone cutanee in presenza di lesioni come ausilio per la diagnosi di melanomi*, European Institute of Oncology, Milano, Italy.

2014–2016   Subcontractor, Unit PI, AIRC Grant: *Retrospective and prospective study of late radiation damages after focal radiotherapy for childhood brain tumors*;

2017–2019   Subcontractor, Unit PI, AIRC Grant: *Radiogenomics Framework for Non-Invasive Personalized Medicine in Head and Neck Cancer* ;

2017–2019   Subcontractor, Unit PI, AIRC Grant: *Translational correlates to ongoing phase II studies on paranasal sinus cancer treated with a multimodal approach* ;

Principal Investigator - [Industrial Grants]

2001–2002   Industrial grant: *Tomography reconstruction of electronic circuits* (Ricostruzione tomografica di circuiti elettronici), Piergiacomi Sud, Monteprandone (AP).

2010   Industrial grant: *Simultaneous Analysis of arterial pressure signals and evaluation of emodynamic parameters*. Flag Vascular srl, Monza, Italy.

2013   Industrial grant: *Multilead novel ECG*, 4–Medical Innovation, Legnano, Italy.

2015   Industrial grant: *Algorithm for ECG signal analysis in monitoring applications*, WinMedical, Pisa, Italy.

Principal Investigator - [PhD Fundings]

2006–2010   PhD fundings by Sorin Group, Saluggia, Italy.

2017-2019   PhD Funding by Università della Svizzera Italiana and Cardiocentro Ticino, Switzerland.

Project Collaborator

1996–1997   MIUR project: *Elaborazione di segnali ed integrazione di immagini per lo studio delle risposte dinamiche nel Sistema Nervoso Centrale*;

1994–1997   EU project: *Improving Control of Patient Status in Critical Care (IMPROVE)* belonging to EU DG XII BIOMED-1 program.

1997–2000   EU project: *Improved Monitoring for Brain Dysfunction in Intensive Care and Surgery (IBIS)* belonging to European Union DG-XII BIOMED-2 programme

2001–2002	MIUR project: *Metodologie e tecnologie per la valutazione delle relazioni strutturali e funzionali tra Sistema Nervoso Autonomo e Sistema Nervoso Centrale*;
2003	Industrial grant: *Design and development of hardware/software analysis modules*, Ela Medical, France.

Evaluator of Project/Research Proposal

09/2007	Member of the Evaluation Panel for *EU Collaborative Project* Call HEALTH–2007-1.2.1, Development of a hybrid imaging system, Brussels.
07/2011	Member of the Evaluation Panel for Biomedical Engineering subarea of the Health Sciences area, Project Call by the *Science and Technology Foundation (FCT), Portugal.*
11/2011	Evaluator of Research Proposals for the *Research Promotion Foundation, Lefkosia, Cyprus.*
11/2011	Evaluator of Research Proposals for *PRIN Call by the Italian Ministry of Research & University.*
10/2012	Member of the Bioengineering, Biotechnology and Biochemistry Evaluation panel for the Project Call by the *Science and Technology Foundation (FCT), Portugal.*
11/2012	Evaluator of Research Proposals for the *Czech Science Foundation.*
11/2011	Evaluator of Research Proposals for *PRIN Call by the Italian Ministry of Research & University.*
01/2013	Reviewer for the Quality of Research Evaluation Initiative (VQR 2004-2010) by the *Italian Ministry of Research & University.*
08/2013	Chair of the Evaluation panel (areas: (a) Bioengineering, Biotechnology and Biochemistry; (b) Materials Science and Engineering) for the Exploratory Projects 2013 Call by the *Science and Technology Foundation (FCT), Portugal.*
03/2013	Evaluator of Research Proposals for the Future in Research Call by the Italian *Ministry of Research & University.*
03/2013	Evaluator of Research Proposals for the PRIN 2013 Call by the *Italian Ministry of Research & University.*
03/2015	Chair of the "Bioengineering, Biotechnology and Biochemistry" panel of the *Science and Technology Foundation (FCT), Portugal.*
11/2015	External Evaluator for Research proposal for the call "Prevention practices and treatment of civilization diseases -

	STRATEGMED" of the *National Centre for Research and Development (NCRD), Poland.*
04/2016	External Evaluator of Research proposal for *ANEP - Ministerio de Economa y Competitividad, Madrid, Spain.*
05/2016	Expert evaluator for the call H2020-FETPROACT-01-2016 - *European Commission.*
02/2017	Member of the Biomedical Engineering Review panel for the *Academy of Finland, Finland.*
03/2017	Chair of the "Bioengineering and Biotechnology" panel, 2017 Call for SR&TD Project Grants of the *Science and Technology Foundation (FCT), Portugal.*
11/2017	Member of the evaluation panel for the Infotech Institute Research Projects at the *University of Oulu, Finland.*
02/2018	Member of the Biomedical Engineering Review panel for the *Academy of Finland, Finland.*
06/2018	Appointed Chair of the " Medical engineering" panel, Stimulus of Scientific Employment, Individual Support - 2017 Call of the *Science and Technology Foundation (FCT), Portugal.*

Organization of Scientific Events

Program Chair

07/2012	Program Chair of the VII International workshop on Biosignal Interpretation (BSI2012), 2-4 July, Como, Italy.
08/2015	Program Chair of the 37th IEEE-Engineering in Medicine and Biology Society (EMBC 2015), 25-29 August, Milano, Italy.
2019	Appointed Program Chair of the 41th IEEE-Engineering in Medicine and Biology Society (EMBC 2019), Berlin, Germany.

Track Chair

09/2009	Track Chair of Biosignal Processing inside Theme 4, Medical Physic and Biomedical Engineering World Congress 2009, 7-12 September, Munich, Germany.

Member of Program/Scientific Committees

09/2013	Member of the Scientific Committee of the XIII Mediterranean Conference on Medical and Biological Engineering and Computing (MEDICON), Sevilla, Spain, 25-28 September, 2013.

09/2014	Member of the Scientific Committee of the VI European Conference of the International Federation for Medical and Biological Engineering (MBEC2014), Dovrovnik, Croatia, 7-11, Sept. 2014.
09/2014	Member of the Program Committee of the International Congress on Cardiovascular Technologies (CARDIOTECH-NIX 2014), Roma, Italy.
09/2014	Member of the International Scientific Committee of the 8th Biosignal Interpretation Workshop (BSI2016), Osaka, Japan.
09/2017	Member of the International Program Committee of the 4th IEEE Middle East Conference on Biomedical Engineering, Tunis, Tunisia.

Organizing Committees

1995	Organizing Committee of the I International Summer School of the IEEE Engineering in Medicine and Biology Society, Certosa di Pontignano, Siena, Italy.
1999	Organizing Committee of the III International Summer School of the IEEE Engineering in Medicine and Biology Society, Certosa di Pontignano, Siena, Italy.
2003	Organizing Committee of the V International Summer School of the IEEE Engineering in Medicine and Biology Society, Certosa di Pontignano, Siena, Italy.
2002	Organizing Commettee of the 4th International Workshop on Biosignal Interpretation (BSI2002), Villa Olmo, Como, Italy.

Member of PhD Commissions/Tribunals

2000	Member of the Tribunal of PhD defense at the University of Zaragoza, Spain. (Candidate: Javier Mateo Gascon).
2006	Member of the Tribunal of PhD defense at the University of Zaragoza, Spain. (Candidate: Raquel Bailon).
2006	Member of the Commission of PhD final examination at the Politecnico di Milano.
2007	Member of the Tribunal of PhD defense at the Polytechnic University of Catalunia, Barcelona, Spain. (Candidate: M.E. Palacios Munoz).
2008	Member of the Tribunal of PhD defense at the Polythecnic University of Valencia. (Candidate: Maria de la Salud Guillem)

2009	Member of the Commission of PhD final examination at the University of Padova.
2009	Member of the Commission of PhD final examination at the University of Pavia.
2009	Member of the Tribunal of PhD defense at University of Porto, Portugal. (Candidate: Sonia Gouveia)
2010	Member of the Tribunal of PhD defense at University of Nice, France. (Candidate: Pietro Bonizzi)
2011	Member of the Tribunal of PhD defense at University of Zaragoza, Spain. (Candidate: Anna Minchole)
2011	Member of the Tribunal of PhD defense at the Polythecnic University of Valencia, Spain. (Candidate: Andreu Climent)
2013	Member of the Commission of PhD final examination at the Politecnico di Milano
2013	External Examiner in the Viva PhD defense at the Leicester University, UK. (Candidate: Joao Salinet)
2016	*President* of the Tribunal of PhD defense at University of Zaragoza, Spain. (Candidate: Alejandro Alcaine)
2017	Member of the Tribunal of PhD defense at the Echole Politechnique de Lausanne, Switzerland. (Candidate: Leila Mirmohamadsadeghi)
2017	Member of the Tribunal of PhD defense at the University of Rennes, France. (Candidate: Mireila Calvo)
2017	Member of the Tribunal of PhD defense at the Politecnico di Milano, Italy. (Candidate: Martin Yebra Alba Pilar)
2018	*President* of the Tribunal of PhD defense at the Politecnico di Torino, Italy. (Candidate: Cristina Caresio)

Invited Lectures

2004	*Quadratic Time–Frequency Representations*, XXIII Annul School in Bioengineering, Bressanone, Italy.
2005	*Advanced Biomedical Signal Analysis*, 14th International Conference of Medical Physics in Nuremberg, Germany
2005	State–of–the–art Lecture: *The autonomic nervous system in atrial fibrillation initiation and maintenance*, NordForsk Network Workshop on BioSignal Processing in Atrial Fibrillation, Lund, Sweden.
2007	*Multiscale analysis of Atrial Fibrillation*, 6th IEEE–EMBS Summner School on Biomedical Signal Processing, Siena, Italy.

2009	*Cardiovascular variability signals: the epiphany of complex regulating systems*, *BiYOMUT* 2009 Satellite symposium on emerging technologies in biomedicine, Izmir, Turkey
2009	*Signal processing in atrial fibrillation: a multiscale perspective* at Digital Signal Processing in Cardiovascular Research Workshop, University of Leicester, UK.
2011	*Biomedical Signal processing and the case of Heart Rate Variability*, University of Lisbon, Portugal.
2013	*The Utility Metric*, Workshop on BCI Performance Metrics at the *BCI* 2013 Meeting, Asilomar Conf. Center, CA, USA.
2013	*A Model of the Atrioventricular Node Function During Atrial Fibrillation*, University of Leicester, UK.
2015	*HR and Blood pressure variability during AFIB*, Atrial Signals 2015 workshop, Karlsruhe, Germany.
2017	Opening Lecture *Signal Processing and Modeling Approaches in Atrial Fibrillation* at th XXXV Congreso Anual de la Sociedad Espaola de Ingeniera Biomdica (CASEIB2017), Bilbao, Spain.

3 Scientific Activity & Expertise

Luca Mainardi's research activity is in the eld of biomedical signal and image processing and biomedical system modeling with applications to the cardiovascular system. He is studying and developing methods for time-frequency analysis, recursive parametric identification and nonlinear analysis of cardiovascular signals and series. He is interested in advanced biomedical image processing techniques for features extraction and image registration for oncology applications. In the following a brief description of the research lines and the main achievements of these researches.

3.1 Time-Variant/Time-Frequency Analysis of Biomedical Signals

This research activity was focused on the design and development of novel tools for time–frequency representation of biomedical signals and series.The main methodological/scientific contributes by L. Mainardi in this area were:

- the introduction of time–variant approaches to the analysis of Hear Rate Variability (HRV) signals [2,16];

- the development of automatic method for the tracking of spectral components in both time–variant approaches [6] and time–frequency representations [35];

- the introduction of multivariate time–variant models and methods for computation of time–variant cross–spectra and partial–spectra [81,82];

- the study of the relationship between Autonomic Nervous System (ANS) and ischemia (spontaneous or pharmacological induced [10]), the assessment of respiratory influence on cardiovascular signals [79,82] or the characterization of Photopletismographic–derived HRV [66].

In this area, Prof. Mainardi's review papers are [31,59].

3.2 Atrial Fibrillation Assessment by Signal Processing Techniques

This research activity is focused on the characterization of Atrial Fibrillation (AF) dynamics from the level of atrial electrogram, through the ECG signals up to the interaction/relationship between AF and ANS. The main methodological/scientific contributes by L. Mainardi in this area were:

- the characterization/identification of endocavitary signal dynamics by non–linear metrics [26,45];

- a novel mathematical model of AV node behavior during AF [74] and the algorithms for its parametric identification [86];

- a first report on the presence of Low–Frequency Rhythms in Blood pressure variability during AF [60,101];

- the characterization of drug/therapy response by HRV linear and non–linear parameters during AF [102].

- the feasibility of AF detection using minimally intrusive wristband devices [124].

In this area, Prof. Mainardi's review papers are [40,41].

3.3 Cardiac Repolarization Studies

This research activity is focused on the analysis of Twave, the understanding of its origin and the derivation of new prognostic indexes of cardiac arrhythmia. The main methodological/scientific contributes by L. Mainardi in this area were:

- the development of a novel method for the investigation of T–Wave Alternans (TWA) based on Dominant T–Wave paradigm [75];

- the introduction of a new, model–based metric (the V-index) for the assessment of heterogeneity of repolarization dispersion in the ventricles [77].

- Validation of the V–index for risk stratification in Chagas disease [104], for drug arrhythmogenesis evaluation [112] and it diagnostic and prognostic value [121]

3.4 Non–contact recordings of Biomedical signals

This research activity is focused on the extraction of video-PPG signal from video recordings of subjects' face and for its post processing to estimate HR, HRV and Respiratory rate. The main methodological/scientific contributes by L. Mainardi in this area were:

- the analysis of the relationship between HRV and pulse–wave variability obtained by video-PPG signals[118];

- the definition of acquisition parameters on pulse–wave variability obtained by video-PPG [122].

- the analysis of the dynamic of Pupil Diameter Fluctuations [92,120];

3.5 Brain Computer Interface

This research activity is focused on the analysis of EEG signal and evoked response during Brain Computer Interface (BCI) and to the evaluation of BCI system performances. The main methodological/scientific contributes by L. Mainardi in this area were:

- the introduction of a new concept (the Utility metric) for the evaluation of BCI system performances [65];

- the development of a novel Genetic Algorithm for P300 Detection [91];

- the feasibility of online detection of error potentials in a BCI speller paradigm [70].

In this area, Prof. Mainardi's review papers is [105].

3.6   Biomedical Image Processing

This research activity is focused on the development of MR image segmentation, registration techniques and Radiomics for oncology applications and is aimed at lesions detection, staging and classification. Segmentation and registration techniques are also applied to reconstruct stented coronary arteries from OCT images. The main methodological/scientific contributes by L. Mainardi in this area were:

- the design of a novel, fast and robust registration method for MRI breast and liver images [46];

- the development of a tool for the quantitative evaluation of the effect of radiotherapy ablation of liver [94];

- the development of atool for Radiomic characterization of oncological lesions [128];

- the development of realistic models for computational simulations of: a) the electromagnetic effects of implanted DBS (Deep Brain Stimulator) [88] and b) a computer assisted breast surgery [95];

- the development of semi-automated methods for patient-specific stent 3D reconstruction and fluidodinamic simulations [123,126].

3.7   Biomedical Signal Processing - Miscellaneous

The research activities is focused on the development of novel signal processing techniques for the analysis of biomedical signal of different origins with various aims. In addition to the results detailed in the previous sections, other applications include:

- a novel wavelet–packets decomposition algorithm for metabolite quantification in 1H-MR spectra [32];

- the characterization of human postural sway using Entropy measurements in normal and development disabilities [96,99];

- the characterization of patient state/response in intensive care [22,213];

- the study of electromagnetic led effects produced by GSM cellular phone [52,93];

- the characterization of human attention and emotions [91,92].

Journal Articles

[1] A. M. Bianchi, L. T. Mainardi, and S. Cerutti, "Batch and time-variant parametric spectral analysis for respiratory component estimation in heart rate variability signal," *JOURNAL OF AMBULATORY MONITORING*, vol. 5, pp. 107–121, 1992, ISSN: 0951-1830.

[2] A. M. Bianchi, L. T. Mainardi, E. Petrucci, M. G. Signorini, M. Mainardi, and S. Cerutti, "Time-variant power spectrum analysis for the detection of transient episodes in HRV signal," *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*, vol. 40, pp. 139–144, 1993, ISSN: 0018-9294.

[3] S. Cerutti, G. Baselli, A. M. Bianchi, L. Mainardi, M. G. Signorini, and A. Malliani, "Cardiovascular variability signals:from signal processing to modelling complex physiological interactions," *AUTOMEDICA*, vol. 16, pp. 45–69, 1994, ISSN: 0095-0963.

[4] L. T. Mainardi, A. M. Bianchi, and S. Cerutti, "On-line beat-to-beat monitoring of spectral parameters of heart rate variability signal using a pole-tracking algorithm," *METHODS OF INFORMATION IN MEDICINE*, vol. 33, pp. 85–88, 1994, ISSN: 0026-1270.

[5] A. V. S. Ghiringhelli, E. Petrucci, L. T. Mainardi, F. Galdangelo, and M. Bertinelli, "Automatic analysis of pacemaker function in long-term ECG recordings," *JOURNAL OF AMBULATORY MONITORING*, vol. 8, pp. 107–116, 1994, ISSN: 0951-1830.

[6] L. T. Mainardi, A. M. Bianchi, G. Baselli, and S. Cerutti, "Pole-tracking algorithms for the extraction of time-variant heart rate variability spectral parameters," *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*, vol. 42, pp. 250–259, 1995, ISSN: 0018-9294.

[7] I. Korhonen, L. T. Mainardi, P. Loula, G. Carrault, G. Baselli, and A. Bianchi, "Linear multivariate models for physiological signal analysis: Theory," *COMPUTER METHODS AND PROGRAMS IN BIOMEDICINE*, vol. 51, pp. 85–94, 1996, ISSN: 0169-2607.

[8] I. Korhonen, L. Mainardi, G. Baselli, A. Bianchi, P. Loula, and G. Carrault, "Linear multivariate models for physiological signal analysis: Applications," *COMPUTER METHODS AND PROGRAMS IN BIOMEDICINE*, vol. 51, pp. 121–130, 1996, ISSN: 0169-2607.

[9] E. Petrucci, S. Ghiringhelli, V. Balian, L. T. Mainardi, and M. Bertinelli, "Clinical evaluation of algorithms for ST measurement during exercise test," *CLINICAL CARDIOLOGY*, vol. 19, pp. 248–252, 1996, ISSN: 0160-9289.

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