

Francesco Rea

CONTACT INFORMATION

PERSONAL

Date of birth: 14th October 1982
Nationality:

RESEARCH SYNOPSIS

Francesco Rea graduated in B.Sc. Information Engineering at the Università di Bergamo in 2004 and specialized in Computer Engineering at the Università di Bergamo in 2007. He got a M.Sc. degree in Robotics and Automation at the University of Salford, Greater Manchester University UK in 2008 with distinction final mark and a Ph.D degree in Robotics at the University of Genoa in 2012 contributing to different EU project (PO-ETICON, eMorph) . He joined the Istituto Italiano di Tecnologia (IIT) in 2013 as fellow to support research on the perception and cognitive modeling and human-robot interaction in the EU project DARWIN. He was involved on a research program of study and dynamic simulation of human body under loads as Post Doctoral fellow at the Istituto Italiano di Tecnologia (IIT) in collaboration with US Department of Defense (Natick, USA). He spent research periods at the Applied Cognitive Neuroscience laboratory of University of Lethbridge (Alberta, Canada) and at the Emergent Robotics Lab. of the Osaka University. Since 2016 he is scientific responsible of the robotics development for Cognitive Architecture and Interaction at the RBCS Department at Istituto Italiano di Tecnologia (Genoa). Starting from 2017, he teaches courses on Cognitive Robotics for Human Robot Interaction to University of Genoa students. He is team-leader for RBCS development of Pilot project on Embodied “Social” Intelligence for human-robot interaction for ROBOCOM++ (rethinking robotics for the robot companion of the future) international research project under FLAG-ERA second joint transnational call. In 2017, he won Canada-Italy Innovation Award with the title “Computational Neuroscience models for auditory aware robots” aiming at providing humanoid robots with auditory awareness in collaboration with the University of Lethbridge. His main areas of interest are modeling and replication of human and humanoid perception and cognitive skills, human-robot interaction and dynamic simulation of multi-body systems. In 2018, he was appointed as Adjunct Associate Professor at the University of Lethbridge and won Mitacs Globalink Research award as participating professor. In 2020, he received grant as principal investigator and leader of a team at the IIT for two H2020 projects: VOJEXT (Value Of Joint EXperimentation in digital Technologies for manufacturing and construction) and APRIL (multipurpose robotics for mAniPulation of defoRmable materIaLs in manufacturing processes).

RESEARCH AREAS

robotics, manipulation, control, developmental learning, skill acquisition, reinforcement learning, artificial intelligence, machine learning, developmental psychology, motor control.

EDUCATION

Ph.D., Robotics, University of Genoa, 2009-2012

- Topic: “ The role of actions for perception: improving perception abilities of the humanoid iCub”
- Thesis: “ From Perception to Cognition : A Quest for Effective Active Vision in Human-Robot Interaction”
- Tutor: Prof. Giorgio Metta and Dr. Lorenzo Natale
- Final Mark: Distinction

M.Sc., Robotics and Automation, University of Salford, UK, September 2007-September 2008 .

- Thesis: “ Ontology Enhancing Process for a Situated and Curiosity-Driven Robot”
- Tutor: Dr. Samia Nefti-Meziani
- Final Mark: Distinction

B.Sc., Computer Engineering, Information Technology for Industry curriculum March 2007.

- Thesis: “Localization method for mobile robots using WiFi sensors”
- Tutor: Prof. Davide Brugali

B.Sc., Information Engineering, December 2004.

- Thesis: “ Model of a Continuous Current Motors”
- Tutor: Prof. Fabio Previdi

PROFESSIONAL EXPERIENCE

Researcher and team-leader in cognitive robotics and human-human interaction laboratory
January 2015 – February 2020

The objectives comprise obtaining fully functional models of human-robot interaction. The scientific aim of the research of this group is to investigate the sensory and motor mechanisms underlying mutual understanding in human-human interaction, with the technological goal of designing robots that can naturally cooperate with people in carrying out everyday tasks. The peculiarity of our approach is that robots, rather than being just the final goal of the research, are used as the ideal tool to investigate social interaction in a principled way. Selected projects in Research Period:

ROBOCOM++ (rethinking robotics for the robot companion of the future) international research project under FLAG-ERA second joint transnational call: Team leader and supervisor of the PhD student responsible for Pilot3.5: cognitive framework

joint-lab NISSAN-IIT: Team leader and supervisor of the PhD student and Post-Doc working on the two-year project of a social robot

VOJEXT(Value Of Joint EXperimentation in digital Technologies for manufacturing and construction): Team leader for IIT and supervisor of one Post-Doc for the provision a favourable business and technological framework to enable matchmaking and encourage producers and adopters (mainly SMEs including small crafters) of Cognitive autonomous systems for human-robot interaction, specially “cobots”, dynamizing science-driven industry approaches for the European industry

APRIL (multipurpose robotics for mAniPulation of defoRmable materIaLs in manufacturing processes): Team leader for IIT and supervisor of one Post-doc aiming at the implementation and deployment of market oriented, low cost and multipurpose robots that supports semiautomatic tasks in manufacturing production lines that use flexible or deformable materials

Researcher - DARWIN "Dextrous Assembler Robot Working with embodied INtelligence"
January 2014 – June 2014

The objectives comprise obtaining fully autonomous mode in the humanoid robot iCub

via cognitive models of reasoning. Cognitive models emulate reasoning models studied in humans which relate to the ability to effectively generalize and transfer previous knowledge into novel tasks. In project new techniques guarantee that past experiences, memorized in the short- and long-term memory, are used as plateau for novel experiences. In the cognitive system such complex cognitive mechanism interact with the perception stage in the humanoid robot iCub. The interaction performs in real-time on a fully developmental robotic system.

Researcher - "Consequences of loading on postural-focal dynamics" **January 2013 – December 2013**

The objectives comprise different important investigation in the study of whole body synergy formation under loading conditions. The task space analysis and investigates the effects of loading on reduction in the available degrees of Freedom is the chief goal of the survey. In the same project postural affordances and lack of access to physical /functional workspace is exploited in order to achieve models of biological control. Another aspect addressed in the professional experience is investigation into systems-level dynamics of postural-focal coupling under load during the execution of motor tasks in unstructured (and often unpredictable) environmental conditions using a biologically feasible approach to motor control i.e. the Equilibrium point hypothesis (EPH) and Passive motion paradigm (PMP). The study has been carried on by implementing models of the dynamics systems involved in simulation environment (OpenSim). In this simulation system aspects such as stabilization of unstable tasks, motor skill learning and tool use in the presence of ‘perceptual, motor and cognitive’ loads have been under detailed study.

Researcher - cognitive skills of the humanoid robot iCub **June 2009— December 2012**

Software engineer at the Italian Institute of Technology. Duties included porting existing code about visual attentive system based on biological evidences from previous humanoid robotic platform (babybot) to humanoid robot ICUB. Implementation of biological evidences concerning the visual attentive system on the humanoids robot Icub. Exploiting different sensorial/acquisition mechanisms embedded in the humanoid robot Icub within the visual attention framework. This enhanced the researcher’s knowledge in the field of traditional vision thanks to the use of traditional frame-based camera. In addition the research carried on in the area of neuromorphic engineering gives deep and strong knowledge on software programming in the field of event-based vision. Generally speaking event-based programming because its profound different mechanisms widen the perspective as software developer.

Selected projects in Research Period:

Emorph: Event-Driven Morphological Computation for Embodied Systems. FP7-ICT Grant agreement ID: 231467

GRANT AWARDS

Canada-Italy Innovation Award - 150 anniversary

- Title : "Computational Neuroscience models for auditory aware robots"
- funded : Italian Embassy, Canada

ACADEMIC
TEACHING

Course: "Human Robot Interaction"

- Academic Course: Doctoral Degree, University of Genoa, Italy

- Period : academic year 2016/2017, academic year 2017/2018, academic year 2018/2019
- Course: "Human Robot Interaction"
- Academic Course: Bachelor Degree, University of Osaka, Japan
 - Period : academic year 2017/2018, academic year 2018/2019
- Course: "Cognitive Robotics for Human Robot Interaction"
- academic course: Doctoral Course, University of Genoa, Italy
 - period : academic year 2019/2020

ACADEMIC
SUPERVISION:
GRADUATE
STUDENTS

Alexander Mois Aroyo

- study : Bringing Human Robot Interaction towards Trust and Social Engineering
- period : November 2015 - November 2018

Fabio Vannucci

- study : Make humanoids understand human actions
- period : November 2016 - November 2019

Ana Tanevska

- study : Implementing a self learning agent on the iCub platform using robot emotion as a reinforcement mechanism
- period : November 2016 - November 2019

Jonas Pierre Gustavo Gonzalez Billandon

- study : Robotcom++: Embodied "Social" Intelligence for human-robot interaction
- period : November 2017 - November 2020

Elena Maria Lechuga Redondo

- study : Visual cues for mutual understanding in human-robot interaction
- period : November 2018 - November 2021

Dario Pasquali

- study : Cyber-physical social security applied to emergent innovative technologies
- period : November 2018 - November 2021

Giulia Belgiovine

- study : Transferring of human-robot interaction competencies: towards robot symbiosis in the acquisition of new skills
- period : November 2018 - November 2021

Motonobu Aoki

- study : The role of Social Signals in human-robot communication
- period : November 2019 - November 2022

Carlo Mazzola

- study : Cognitive robotics for shared perception in human robot interaction
- period : November 2019 - November 2022

Luca Garello

- study : Cognitive-inspired models for motion understanding for human-robot interaction
- period : November 2019 - November 2022

Omar Khaled Elsayed Mohamed Eldardeer

- study : Computational Neuroscience models for auditory aware robots
- period : November 2019 - November 2022

Linda Lastrico

- study : Make humanoids understand and synthesize human actions
- period : November 2019 - November 2022

AFFILIATIONS

EU Cognition:1st European Network for the Advancement of Artificial Cognitive Systems, Interaction and Robotics
EU Cognition:2nd European Network for the Advancement of Artificial Cognitive Systems, Interaction and Robotics
EU Cognition:3rd European Network for the Advancement of Artificial Cognitive Systems, Interaction and Robotics

TRAINING AND DEVELOPMENT UNDERTAKEN

The 2010 CapoCaccia Cognitive Neuromorphic Engineering Workshop, Capo Caccia, Sardinia, Italy, Sunday 2010-04-25 to Saturday 2010-05-08

- reference : <http://capocaccia.ethz.ch/capo/wiki/2010>
- funded : The European Commission FP7 FET Programme, The US National Science Foundation.

MLSS Machine Learning Summer School, Sardinia, May 6 - May 12, 2010

- reference : <http://www.mlss.cc/sardinia10>
- funded : PASCAL - Pattern Analysis, Statistical Modelling and Computational Learning

EMBODIED INTELLIGENCE Summer School, Livorno, Italy, September 20-24, 2010

- reference : <http://www.octopusproject.eu/summerschool.html>
- funded : FET-Proactive Initiatives Calls in FP7 , The European Commission FP7 FET Programme

The 2011 CapoCaccia Cognitive Neuromorphic Engineering Workshop, Capo Caccia, Sardinia, Italy, Wednesday 2011-04-27 to Saturday 2011-05-14

- reference : <http://capocaccia.ethz.ch/capo/wiki/2011>
- funded : The European Commission FP7 FET Programme, The US National Science Foundation.

2012 CapoCaccia Cognitive Neuromorphic Engineering Workshop, Capo Caccia, Sardinia, Italy, Sunday 2012-04-29 to Saturday 2012-05-12

- reference : <http://capocaccia.ethz.ch/capo/wiki/2012>
- funded : The European Commission FP7 FET Programme, The US National Science Foundation.

2017 CapoCaccia Cognitive Neuromorphic Engineering Workshop, Capo Caccia, Sardinia, Italy.

- reference : <http://capocaccia.iniforum.ch/>
- funded : The European Commission FP7 FET Programme, The US National Science Foundation.

SELECTED PUBLICATIONS

Can a robot catch you lying? A machine learning system to detect lies during interactions. (Gonzalez-Billandon J., Aroyo A., Tonelli A., Pasquali D., Sciutti A., Gori M., Sandini G., Rea F.), *Frontiers*, 2019

Cultural differences in speed adaptation in Human-Robot interaction tasks (Vannucci F., Sciutti A., Lehmann H., Sandini G., Nagai Y., Rea F.), *PALADYN - Journal of Behavioral Robotics*, 2019

The perception of a robot partner's effort elicits a sense of commitment to human-

robot interaction (Szekely M., Powell H., Vannucci F., Rea F., Sciutti A., Michael J.), Interaction Studies, 2019

Trust and Social Engineering in Human Robot Interaction: Will a Robot Make You Disclose Sensitive Information, Conform to Its Recommendations or Gamble? (Aroyo A.M., Rea F., Sandini G., Sciutti A.) IEEE Robotics and Automation Letters, 2018

Detecting biological motion for human-robot interaction: A link between perception and action (Vignolo A., Noceti N., Rea F., Sciutti A., Odone F., Sandini G.) Frontiers Robotics AI, 2017

Human activity detection on the robot iCub (Vignolo A., Noceti N., Rea F., Sciutti A., Odone F., Sandini G.) 9th International Workshop on Human Friendly Robotics, Genoa, Italy, 2016

Revisiting the body-schema concept in the context of Whole-Body Postural-Focal Dynamics (P. Morasso, M. Casadio, V. Mohan, F. Rea, J. Zenzeri) Frontiers in Human Neuroscience, 2015

Sandini, G.; Noceti, N.; Sciutti, A.; Rea, F.; Verri, A.; Odone, F., Computational model of biological motion detection G.Sandini Vision Science Society Meeting 2015 (under evaluation)

Noceti, N.; Sciutti, A.; Rea, F.; Odone, F.; Sandini, G., 'Estimating human actions affinities across views', International Conference on Computer Vision Theory and Applications (VISAPP) 2015

Sandini G., Noceti N., Sciutti A., Rea F., Verri A., Odone F., 'Modeling visual features to recognize biological motion: a developmental approach', MODVIS 2015, St. Pete Beach, FL, U.S.A, May 13-15, 2015

Palinko O., Rea F., Sandini G. and Sciutti A. 2015, 'Gaze Tracking for Human Robot Interaction', Accepted for the International Workshop on Vision and Eye Tracking in Natural Environments and Solutions and Algorithms for Gaze Analysis, Bielefeld, Germany, September 29-30, 2015.

How good? Better. How simple? Simpler. And testable to boot. (N. Wilkinson, A. Paikan, G. Gredebäck, F. Rea, G. Metta), Developmental Science, 2014

Ontology enhancing process for a situated and curiosity-driven robot (F. Rea, S. Nefti-Meziani, U. Manzoor, S. Davis), Robotics and Autonomous Systems, 2014

Peterpan: a simulation package of whole body actions in humans and humanoids (F. Rea, P. Morasso, G. Sandini), International Conference BioMedical Engineering and

Biotechnology, 2014

Motor biases in visual attention for the iCub humanoid robot (F.Rea, G. Metta, G. Sandini) IEEE-RAS International Conference on Humanoid Robots, 2014

The informative content of the optical flow feature of flow features of biological motion
ECVP 2014

Palinko, O.; Sciutti, A.; Rea, F.; Sandini, G., ‘ Towards Better Eye Tracking in Human Robot Interaction Using an Affordable Active Vision System’, 2nd International Conference of Human-Agent Interaction, 2014

Morasso P., Casadio M., De Santis D., Nomura K., Rea F. and Zenzeri J., ‘Stabilization strategies for unstable dynamics’, Journal of Electromyography and Kinesiology , vol. 24, pp. 803-814, 2014

Biological motion understanding for human-robot interaction (N.Noceti, A.Sciutti, F.Rea, F.Odone, A.Verri, G.Sandini), Vision for Language and Manipulation BMVA symposium, 2014

Palinko O., Sciutti A., Patanè L., Rea F., Nori F. and Sandini G., ‘Communicative Lifting Actions in Human-Humanoid Interaction’, IEEE-RAS International Conference on Humanoid Robots , Madrid, Spain, November 2014

Sciutti, A.; Palinko, O.; Patanè, L.; Rea, F.; Nori, F.; Noceti, N.; Odone, F.; Verri, A.; Sandini, G., ‘Bidirectional Human-robot action reading’, Human-Friendly Robotics Workshop (HFR 2014), 2014

Bhat, A., Mohan, V., Rea, F., Morasso, P. Sandini, G. (2014), Connecting experiences: A biologically inspired memory for developmental robots. 4TH IEEE ICDL-EpiRob, Genova, Italy.

Sciutti A., Rea F. and Sandini G., ‘When you are young, (robot’s) looks matter. Developmental changes in the desired properties of a robot friend’, The 23rd IEEE International Symposium on Robot and Human Interactive Communication , Edinburgh, Scotland, August 25-29, 2014

Sciutti A., Palinko O., Patanè L., Rea F., Nori F., Noceti N., Odone F., Verri A. and G. Sandini, ‘Bidirectional Human-robot action reading’, Human-Friendly Robotics Workshop (HFR 2014), Pontedera, Pisa, Italy, October, 23-24, 2014

Sciutti A., Noceti N., Rea F., Odone F., Verri A. and Sandini G. 2014, ‘The informative content of optical flow features of biological motion’, Perception ECVP Abstract Supplement, vol. 43, pp.102, 37th European Conference on Visual Perception (ECVP

2014), Belgrade, Serbia, August, 24-28, 2014

Palinko O., Sciutti A., Rea F., Sandini G. 2014, 'Towards Better Eye Tracking in Human Robot Interaction Using an Affordable Active Vision System', 2nd International Conference of Human-Agent Interaction, Tsukuba, Japan, October, 29-31, 2014

Palinko O., Sciutti A., Rea F., Sandini G. 2014, 'Weight-Aware Robot Motion Planning for Lift-to-Pass Action', 2nd International Conference of Human-Agent Interaction, Tsukuba, Japan, October, 29-31, 2014

Noceti N., Sciutti A., Rea F., Odone F., Verri A. and Sandini G. 2014, 'Biological motion understanding for human-robot interaction', Vision for Language and Manipulation BMVA symposium, London, UK, July, 11th, 2014

Can a robotic attention system simulate infant gazing behavior (K.S. Lohan, F. Rea, G. Metta), In RO-MAN, 2013 IEEE

A biomimetic framework for coordinating and controlling whole body movements in humanoid robots, Morasso, P.; Rea, F.; Mohan, V., Proceedings of IEEE EMBC2013 - Osaka July 3-7, 2013.

Staring us in the face? An embodied theory of newborn face preference (Nick Wilkinson, Ali Paikan, Francesco Rea, Giorgio Metta and Gustaf Gredeback), In Developmental Science

Event-Driven Visual Attention for the Humanoid Robot iCub (F. Rea, G. Metta, C. Bartolozzi), In Frontiers in Neuromorphic Engineering, 2013 IEEE.

Embedded neuromorphic vision for humanoid robots (C. Bartolozzi, F. Rea, C. Clercq, M. Hofstätter, D.B. Fasnacht, G. Indiveri, G. Metta), In IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), 2011

INVITED SPEAKER as invited speaker at The The 1st International Symposium on Symbiotic Intelligent Systems, 2019

- presented : Visual Audio Attention for Human-Robot Interaction

as invited speaker at The 1st International Symposium on Systems Intelligence, 2018

- presented : how synchronization and joint attention play intertwined role in human robot collaboration

as invited speaker at Symbiotic Human-robot interaction - Robotics Science and Systems, 2018

- presented : Emergent Implicit Behaviours in Human Robot Interaction

as keynote speaker at Assistance and Service Robotics in a Human Environment Workshop in conjunction with IEEE/RSJ International Conference on Intelligent Robots and Systems, 2017

- presented : Models of human-humanoid interaction: interaction strategies adaptable to untrained users

RESEARCH INTEREST Robotics, Embedded Systems, Artificial Intelligence, Machine Learning, Reinforcement Learning, Computational Neuroscience, Intrinsic Motivation, Advanced Computer Architecture, Information Theory, Grounding problem, Object Ontology, Human Robot Interaction, Object Recognition and Categorization, Affordances

COMPUTER SKILLS Languages: C++, C#, C, Matlab, HTML, Java, some use of Unix shell scripts. Python with numpy
 Operating Systems: Unix/Linux, Mac OS X, Windows.

LANGUAGES SKILLS Languages: Italian (native), English(fluent)
 Certificate: June 2007 TOEFL iBT 90/120.

REFERED THESES [1]The role of actions for perception: improving perception abilities of the humanoid iCub
 [2]Ontology Enhancing Process for a Situated and Curiosity-Driven Robot
 [3]From Perception to Cognition : A Quest for Effective Active Vision in Human-Robot Interaction

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