

UNIVERSITÀ DEGLI STUDI DI MILANO

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settore scientifico-disciplinare ____M-EDF/02 - Metodi e Didattiche delle Attività Sportive____

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Cristiano ALESSANDRO

CURRICULUM VITAE

INFORMAZIONI PERSONALI (NON INSERIRE INDIRIZZO PRIVATO E TELEFONO FISSO O CELLULARE)

COGNOME	ALESSANDRO
NOME	CRISTIANO
DATA DI NASCITA	22/01/1984

INSERIRE IL PROPRIO CURRICULUM **(non eccedente le 30 pagine)**

ATTIVITA' DI RICERCA

La mia attività di ricerca consiste nello studio dei processi fisiologici coinvolti nella generazione del movimento volontario, con particolare attenzione alla coordinazione muscolare ed alla biomeccanica muscolo-scheletrica. Utilizzo un approccio multidisciplinare che combina l'analisi di dati sperimentali con l'utilizzo di modelli computazionali. Tali ricerche trovano ampia applicazione in scienza dello sport e riabilitazione.

ISTRUZIONE E FORMAZIONE

Feb. 2009/Sett. 2013	University of Zurich. Artificial Intelligence Lab PhD (defense: 20/09/2013) <ul style="list-style-type: none">- Tesi: "Computational implications of the muscle synergy hypothesis"- Supervisore: Prof. Rolf Pfeifer- Referee esterno: Prof. Etienne Burdet
Marzo 2012/Luglio 2012	Italian Institute of Technology (IIT), Genoa, Italy "Robotics, Brain and Cognitive Science" department (RBCS) <ul style="list-style-type: none">- Studente di dottorato in visita
Ottobre 2005/Aprile 2008	Politecnico di Milano Laurea magistrale in ingegneria informatica (2 anni) <ul style="list-style-type: none">- Punteggio finale: 110/110 e lode- Indirizzo: AI, apprendimento automatico, robotica, sistemi di controllo- Tesi: "A tool for evaluating architectures for autonomous robots"- Supervisore: Prof. Andrea Bonarini
Sett. 2006/Gennaio 2007	Chalmers Institute of Technology, Gothenburg, Sweden <ul style="list-style-type: none">- Studente in scambio (programma Erasmus)

Ottobre 2002/Luglio 2005 **Università degli Studi di Catania**
Laurea triennale (3 anni)
- Punteggio finale: 110/110 e lode
- Tesi: “Navigation Control Algorithms based on spiking networks”
- Supervisor: Dr. Mattia Frasca, Dr. Luca Patanè, Prof. Paolo Arena

Sett. 1997/Luglio 2002 **Liceo Scientifico S.Giovanni Bosco, Catania**
Diploma di maturità scientifica
- Punteggio finale: 100/100

Seminari

Genn. 2020 “Hackathon on Cerebellum Modelling” – Pavia, Italia.
Sett. 2014 “Summer School on Neurorehabilitation” – Baiona, Spagna.
Aprile 2014 “Training Event on Stroke Rehabilitation” – Venezia, Italia.
Aprile 2014 “International Workshop on Muscle Synergies” – Venezia, Italia.
Nov. 2012 “Adaptive Motor Primitives in Brains and Machines” – Tübingen, Germania.
Giugno 2011 “Machine Learning Summer School” – Biopolis, Singapore.
Luglio 2011 “Summer School on Impedance” – Frauenchiemsee, Germania.
Luglio 2009 “Robot Learning Summer School” – Lisbona, Portogallo.
Luglio 2009 “Multimodal and Cognitive System Summer School” – Zurigo, Svizzera.
Marzo 2007 “From Kalman to Particle Filters” – Parigi, Francia.

Certificazioni per la sperimentazione sull’uomo

Luglio 2014 “Introduction to research”, Training and Resources in Research Ethics Evaluation (TRREE).
Luglio 2014 “Research ethics evaluation”, TRREE.
Luglio 2014 “Informed consent”, TRREE.
Luglio 2014 “Good clinical practice”, TRREE.

Certificazioni per la sperimentazione animale

Marzo 2016 “Introduction to Rats”, American Association for Laboratory Animal Science (AALAS).
Febbraio 2016 “Inhalation Anesthesia Systems for Rodents”, AALAS.
Febbraio 2016 “Post-Procedure Care of Mice and Rats in Research: Minimizing Pain and Distress”, AALAS.
Febbraio 2016 “Pain Management in Laboratory Animals”, AALAS.
Febbraio 2016 “Microisolator Training”, AALAS.
Febbraio 2016 “Aseptic Technique for Rodent Survival Surgery”, AALAS.
Gennaio 2016 “Public Health Service Policy on Humane Care and Use of Laboratory Animals”, AALAS.
Gennaio 2016 “Occupational Health and Safety”, AALAS.

ESPERIENZA LAVORATIVA

Ricerca

Gennaio 2020/oggi **Postdoc**
Università di Pavia, Pavia, Italia
- Argomenti: Controllo motorio, apprendimento motorio, neuroscienze computazionali, neurofisiologia
- Supervisore: Prof. Egidio D’Angelo

Gennaio 2016/Dicembre 2019 **Postdoc**
Northwestern University, Chicago, USA
- Argomenti: Controllo motorio, biomeccanica, neurofisiologia
- Supervisore: Prof. Matthew Tresch

Gennaio 2014/Giugno 2015	Postdoc ETH Zurich, Sensory-Motor Systems Lab - Argomenti: Controllo motorio, biomeccanica, analisi di segnali fisiologici (EMG, pressione arteriosa, battito cardiaco) - Supervisore: Prof. Robert Riener
Febbraio 2009/Sett. 2013	Assistente alla ricerca University of Zurich. Artificial Intelligence Lab. - Argomenti: : Controllo motorio, neuroscienze computazionali, robotica - Supervisore: Prof. Rolf Pfeifer
Sett./Dicembre 2008	Assistente alla ricerca Politecnico di Milano, Department of Electronics and Computer Science - Argomenti: Analisi statistica di segnali fisiologici, machine learning - Supervisore: Prof. Andrea Bonarini
Collaboratori	Matthew Tresch (Northwestern University), Andrea d'Avella (University of Messina), Robert Riener (ETH Zurich), Lee Miller (Northwestern University), Chethan Pandarinath (Emory University), Juan Pablo Carabajal (ETH Zurich), Filipe Barroso (Spanish National Research Council), Ioannis Delis (University of Leeds), Bastien Berret (University of Paris-Sud), Stefano Panzeri (Italian Institute of Technology)
Progetti	
Gennaio 2020/oggi	Human Brain Project (EU H2020)
Gennaio 2016/Dicembre 2019	Neural control of internal joint variables (NIH)
Gennaio/Giugno 2015	NCCR Robotics (SNSF) www.nccr-robotics.ch
Gennaio/Dic. 2014	STAMAS (EU FP7) Smart Technology for Artificial Muscle Applications in Space http://www.stamas.ethz.ch/
Ott. 2012/Sett. 2013	AMARSi (EU FP7) Adaptive Modular Architectures for Rich Motor Skills http://www.amarsi-project.eu/
Ott. 2009/Sett. 2012	RobotDoC (EU FP7 - Marie Curie Fellowship) Robotics for Development of Cognition http://robotdoc.org/
Feb. 2009/Sett. 2011	ECCEROBOT (EU FP7) Embodied Cognition in a Compliant Engineered Robot http://eccerobot.org/
Supervisione di studenti	
Gennaio 2016/Dicembre 2019	Internships (Northwestern University): Alexandra Hruby, Adarsh Prashara, David Tentler, Mario Magnuson, Kareem Dheher, Nathalie Gately. Argomenti: analisi del cammino, elettromiografia, motion tracking
Gennaio 2018/Giugno 2019	Mater thesis, Miss. Hsin-Yun Yeh (Northwestern University) "EMG Analysis of Rat Hindlimb in Different Contexts: from Downslope to Upslope Walking"
Giugno 2014/Maggio 2015	Master thesis, Mr. Robin Urselli (Politecnico di Milano) "Impact of muscle redundancy and nonlinearities on the muscle synergy"

hypothesis: a computational investigation”

Marzo/Agosto 2011

Bachelor thesis, Mr. Mathias Weyland (University of Zurich)
“Reflex learning in a tendon-driven robot”

Attività didattica

Sett./Dic. 2011

“Designing and Programming Embedded Systems for Robots”. Uni. Zurich.

Feb./Luglio 2010

“Artificial Life”. University of Zurich.

Sett./Dic. 2009

“Introduction to AI”. University of Zurich.

Feb./Lug. 2009

“Neural Networks”. University of Zurich.

Marzo/Giugno 2008

“Software Engineering”. Politecnico di Milano.

Sett./Dic. 2007

“Computer Science A”. Politecnico di Milano.

Sett. 2003/Luglio 2004

Tutoring service towards students of first year of engineering university.
University of Catania.

Organizzazione di convegni e attività di revisione

Sett. 2018/oggi

Revisore per Scientific Reports
Revisore per Journal of Neurophysiology

Giugno 2013/oggi

Revisore per Frontiers in Computational Neuroscience
Revisore per Frontiers in Neurorobotics

Genn. 2017/Dic. 2019

Associazione internazionale dei ricercatori italiani (AIRIcercra)
Membro del direttivo del capitolo locale a Chicago

Genn./Sett. 2012

Financial chair per la “Post-graduate conference on Robotics and Development of Cognition”. Lausanne (Switzerland), 10-12 September 2012.

SOCIETA' PROFESSIONALI

- Society for Neural Control of Movements (NCM)
- International Society for Biomechanics (ISB)
- International Society of Posture and Gait Research (ISPGR)
- International Society of Electrophysiology and Kinesiology (ISEK)
- Physiological Society of Italy (SIF)
- Italian Society for Neuroscience (SINS)
- Society for Neuroscience (SfN)
- Professional Engineer Qualification
- International Association of Italian Scientists (AIRIcercra)
- Institute of Electrical and Electronics Engineers (IEEE)

PRESENTAZIONI SU INVITO

Luglio 2019

Neural regulation of internal joint stresses and strains
Università di Pavia, Pavia, Italia, 10 Luglio.

Aprile 2018

Neural control of internal joint variables
Shirley Ryan AbilityLab, Patton Lab. Chicago, USA, 14 Aprile.

Novembre 2017

Neural control of internal joint variables
John Hopkins University, Shadmehr Lab. Baltimora, USA, 17 Novembre.

Giugno 2014	Computational analyses of the muscle synergy hypothesis EPFL, Translational Neural Engineering Laboratory. Losanna, Svizzera, 6 Luglio.
Marzo 2014	Computational implications of the muscle synergy hypothesis Politecnico di Milano, Depart. of Electronics, Computer Science and Bioengineering. Milano, Italia, 14 Marzo.
Luglio 2013	Computational implications of the muscle synergy hypothesis Imperial College of London, Human Robotics Group, Depart. of Bioengineering. Londra, Regno Unito, 12 Luglio.
Maggio 2013	Computational implications of the muscle synergy hypothesis The Weizmann Institute of Science, Dept. of Applied Mathematics and Computer Science. Rehovot, Israele, 7 Maggio.
Giugno 2012	Identification of effective synergies for robot control Santa Lucia Foundation, Laboratory of Neuromotor Physiology. Roma, Italia, 28 Giugno.

PREMI, RICONOSCIMENTI E GRANT

Marzo 2019	Marie Skłodowska-Curie Research Fellowship, Seal of Excellence Riconoscimento di eccellenza del progetto: “Exploiting gamma oscillations for motor recovery”
Giugno 2018	68th Lindau Nobel Laureate Meeting on Physiology or Medicine. Accettazione e travel award. Lindau, Germania. 24-29 Giugno 2018.
Luglio 2015	SNSF Advanced Postdoc Mobility Award Finanziamento della postdoctoral fellowship (24 mesi) “SNSF Advanced Postdoc Mobility Award” bandita dalla Swiss National Science Foundation. “Cortical plasticity during multisensory integration and reach planning”
Feb. 2015	ETHZ Scientific Equipment Grant Finanziamento del progetto dal titolo “Force/torque sensors and corresponding electronics”.
Aprile 2015	NCM Scholarship. Annual meeting of the Society for Neural Control of Movement (NCM). Accettazione e travel award. Charleston, USA. 19-24 Aprile 2015.
Maggio 2013	Miglior poster (secondo classificato). 9 th Computational Motor Control Workshop, Ben-Gurion University of Negev, Beer-Sheva, Israel. 9 Maggio 2013.
Ottobre 2009	Borsa di studio. Marie Curie, Initial Training Network (ITN).

COMPETENZE LINGUISTICHE

- **Inglese:** eccellente scritto e orale (C1).
- **Tedesco:** livello base (A2).

COMPETENZE TECNICHE

- Acquisizione e analisi di segnali elettromiografici (EMG)
- Acquisizione e analisi segnali di cinematici
- Acquisizione e analisi di segnali fisiologici (pressione arteriosa, battito cardiaco, spettroscopia nel vicino infrarosso)
- Analisi della locomozione
- Sistemi di monitoraggio del movimento (Vicon)
- Simulazioni numeriche
- Modellistica muscoloscheletrica
- Modellistica neurale

- Sensoristica (sensori di forza, posizione, giroscopi, accelerometri)
- Gestione di roditori da laboratorio
- Impianto di elettrodi EMG sottocutanei in roditori (chirurgia sterile)
- Impianto di elettrodi cuff in roditori (chirurgia sterile)
- Denervazione muscolare in roditori (chirurgia sterile)
- Recisione del legamento crociato anteriore in roditori (chirurgia sterile)
- Sistemi operativi: Windows OS, Linux OS.
- Linguaggi di programmazione: C/C++, C#, Java, SQL, Python, Matlab, NEST.
- Software: Matlab, Simulink, Labview, Octave, SVN, GitHub, Inkscape.

Pubblicazioni

Riviste internazionali

Alessandro C., Barroso F., Prashara A., Tentler D., Yeh H., Tresch M. (2020). **Coordination amongst quadriceps muscles suggests neural regulation of internal joint stresses, not simplification of task performance.** *Proceedings of the National Academy of Sciences (PNAS)*. 117(14):8135-8142.

Barroso F., Alessandro C., Tresch M. (2019). **Adaptation of muscle activation after patellar loading demonstrates neural control of joint variables.** *Scientific Reports*. 9: 20370.

Alessandro C., Tafreshi A., Riener R. (2019). **Cardiovascular responses to leg muscle loading during head-down tilt at rest and after dynamic exercises.** *Scientific Reports*. 9: 2804.

Alessandro C., Rellinger B., Barroso F., Tresch M. (2018). **Adaptation after vastus lateralis denervation in rats demonstrates neural regulation of joint stresses and strains.** *eLife*. 7:e38215

Alessandro C., Barroso F., Tresch M. (2016). **Working hard to make a simple definition of synergies. Comment on: "Hand synergies: Integration of robotics and neuroscience for understanding the control of biological and artificial hands" by Marco Santello et al.** *Physics of Life Reviews*. 17:24-26.

Alessandro C., Carbajal J.P., d'Avella A. (2014). **A computational analysis of motor synergies via Dynamic Response Decomposition.** *Frontiers in Computational Neuroscience*. 7:191.

Alessandro C., Ioannis D., Nori F., Panzeri S., Berret B. (2013). **Muscle synergies in neuroscience and robotics: from input to task-space perspectives.** *Frontiers in Computational Neuroscience*. 7:43.

Wittmeier S., Alessandro C., Bascarevic N., Dalamagkidis K., Diamond A., Jäntschi M., Jovanovic K., Knight R., Gravato Marques H., Milosavljevic P., Svetozarevic P., Potkonjak V., Pfeifer R., Knoll A., Holland O. (2012). **Towards anthropomorphic robotics: development, simulation, and control of a musculoskeletal torso.** *Artificial Life*. 19(1):171-193.

Riviste (in revisione o in preparazione)

Alessandro C., Barroso F., Prashara A., Yeh H., Sandercock T., Tresch M. **Joint afferent activity determines correlations between the vasti muscles in the rat.** *(in preparation)*.

Yeh H., Alessandro C., Barroso F., Prashara A., Tresch M. **Hindlimb muscle coordination during treadmill locomotion at different speeds and inclines in the rat.** *(in preparation)*.

Wallner J., Alessandro C., Tresch M. **Synergies in the residual space of hindlimb muscle activity in the rats.** *(in preparation)*.

Alessandro C., Prashara A., Yeh H., Tresch M. **Role of knee joint afferent activity during adaptation to VL paralysis in the rat.** *(in preparation)*.

Alessandro C., Prashara A., Yeh H., Tresch M. **Short-term response of quadriceps muscle activation to a model of knee joint effusion.** (*in preparation*).

Song D., Alessandro C., Tresch M. **Coordination between quadriceps and hamstrings muscles after inhibition of knee joint receptors.** (*in preparation*).

Urselli R., Carbajal J.P., Alessandro C. **Number of muscle synergies is determined by musculoskeletal non-linearities, not by muscle redundancy.** (*in preparation*).

Wimalasena L., Braun J., Keshtkaran M., Alessandro C., Gallego J., Miller L., Tresch M., Pandarinath C. **Uncovering de-noised EMG representations using deep learning models of muscle population dynamics.** (*in preparation*).

Alessandro C., Tresch M. **Neural control of internal joint stresses and strains.** (*in preparation*).

Capitoli di libri

Alessandro C., Backers N., Goebel P., Resquin F., Gonzalez J., and Osu R. (2016). **Motor Control and Learning Theories.** Eds. Jose L. Pons, Rafael Raya and Jose Gonzalez. *Emerging Therapies in Neurorehabilitation II*. Biosystems & Biorobotics. 10: 225-250.

Torricelli D., Barroso F., Coscia M., Alessandro C., Lunardini F., Esteban E. B., d'Avella A. (2016). **Muscle Synergies in the Clinical Practice: Potentials and Practical Issues.** Eds. Jose L. Pons, Rafael Raya and Jose Gonzalez. *Emerging Therapies in Neurorehabilitation II*. Biosystems & Biorobotics. 10: 251-272.

Atti di convegni internazionali (peer reviewed)

Presentazioni orali

Alessandro C., Tafreshi A., Riener R. (2016). **Increasing leg blood volume during head-down tilt by performing physical exercises, a preliminary study.** The 6th IEEE International Conference on Biomedical Robotics and Biomechatronics (BioRob), Singapore, Singapore.

Vollmer A.-L., Rucinski M., Alessandro C., Wilkinson N., Navarro-Guerrero N., and Handl A. (2013). **Special Session on Training in Robotics for Development of Cognition (RobotDoC).** The 3rd Joint IEEE International Conference on Development and Learning and on Epigenetic Robotics, Osaka, Japan.

Alessandro C., Carbajal J.P., d'Avella A. (2012). **Synthesis and Adaptation of Effective Motor Synergies for the Solution of Reaching Tasks.** *Lecture Notes in Artificial Intelligence (LNAI)*. Eds. T. Ziemke, C. Balkenius, and J. Hallam (Berlin Springer-Verlag), pag. 33-43.

Alessandro C. and Nori F. (2012). **Identification of Synergies by Optimization of Trajectory Tracking Tasks.** *The Fourth IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics*. Roma, Italy. June 24-27, 2012. pag. 924-930.

Mutti F., Alessandro C., Angioletti M., Bianchi A., Gini G. (2012). **Learning and evaluation of a vergence control system inspired by Hering's law.** *The Fourth IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics*. Roma, Italy. June 24-27, 2012. pag. 931-936.

Kuppuswamy N., Alessandro C. (2011). **Impact of Body Parameters on Dynamic Movement Primitives for Robot Control.** *The European Future Technologies Conference and Exhibition, FET 2011*. Budapest, Hungary.

Marques G. H., Jäntschi M., Wittmeier S., Alessandro C., Lungarella M., Knight R., Holland O. (2010). **ECCE1: the first of a series of anthropomorphic musculoskeletal upper torsos.** *IEEE International Conference on Humanoid Robotics, Humanoid 2010*. Nashville, USA.

Tognetti S., Alessandro C., Bonarini A., Matteucci M. (2009). **Fundamental issues on the recognition of autonomic patterns produced by visual stimuli.** *Affective Computing and Intelligent Interaction*, ACII 2009 – 10/09/2009 Amsterdam, Netherlands.

Arena P., Fortuna L., Frasca M., Patanè L., Alessandro C., Barbagallo D. (2006). **Learning high sensors from reflexes via spiking networks in roving robots.** 8th international *IFAC symposium on robot control*, IFAC Syrcos 2006, 06/08/2006 Bologna, Italy.

Abstract in atti di convegni internazionali (peer-reviewed)

Presentazioni orali

Alessandro C., Tresch M. (2020). **Coordination of quadriceps muscles in the rat suggests minimization of joint stresses rather than simplification of task performance.** 23rd *Congress of the International Society of Electromyography and Kinesiology*. Virtual.

Alessandro C., Barroso F., Tresch M. (2020). **Coordination of quadriceps muscles in rats demonstrates neural regulation of joint stresses, not simplification of task performance.** 30th *NCM Annual Meeting*. Dubrovnik, Croatia.

Alessandro C., Urselli R., Carbajal JP., Riener R. (2015). **Impact of muscle redundancy on the synergy hypothesis.** 25th *NCM Annual Meeting*. Charleston (SC), USA. April 21-24, 2015.

Alessandro Cristiano. (2010). **Movement Control of Biologically Inspired Humanoid Robots.** Marie Curie Workshop, European Science Forum, *ESOF 2010*. Turin, Italy.

Poster

Alessandro C., Song D., Tentler D., Prashara A., Yun-Yeh H., Barroso F., Tresch M. (2019). **Coordination between quadriceps muscles activity in rats suggests neural regulation of joint stresses and strains.** Program No. 316.11. *2019 Neuroscience Meeting Planner*. Chicago, IL: Society for Neuroscience, 2019. Online.

Wallner J., Alessandro C., Tresch M. (2019). **Muscle synergies identified from step-to-step variations of muscle activations during treadmill locomotion in rats.** Program No. 763.17. *2019 Neuroscience Meeting Planner*. Chicago, IL: Society for Neuroscience, 2019. Online.

Wimalasena L., Braun J., Keshtkaran M., Alessandro C., Gallego J., Miller L., Tresch M., Pandarinath C. (2019). **Uncovering de-noised EMG representations using deep learning models of muscle population dynamics.** Program No. 670.05. *2019 Neuroscience Meeting Planner*. Chicago, IL: Society for Neuroscience, 2019. Online

Alessandro C., Rellinger B., Barroso F., Tresch M. (2018). **Restoration of global, but not local, kinematics after denervation of vastus lateralis in rats.** Program No. 150.08. *2018 Neuroscience Meeting Planner*. San Diego, CA: Society for Neuroscience, 2018. Online

Tresch M., Alessandro C., Barroso F., Wei Q., Dhaher Y., Sandercock T., Pai D. (2018). **The nervous system activates muscles to minimize internal joint stresses: evidence from quadriceps muscle activations during motor adaptation in the rat.** 28th *NCM Annual Meeting*. Santa Fe (NM), USA. May 1-4, 2018. (Oral presentation)

Alessandro C., Rellinger B., Barroso F., Sandercock T., Tresch M. (2017). **Adaptation to quadriceps paralysis as a window into neural control of internal joint variables.** Program No. 410.03. *2017 Neuroscience Meeting Planner*. Washington, DC: Society for Neuroscience, 2017. Online

Barroso F., Alessandro C., Sandercock T., Tresch M. (2017). **Adaptations of neural control to mediolateral perturbations of the patella.** Program No. 410.02. *2017 Neuroscience Meeting Planner*. Washington, DC: Society for Neuroscience, 2017. Online.

Tresch M., Alessandro C., Barroso F. (2017). **Correlation between quadriceps muscles during locomotion in the rat.** Program No. 410.04. *2017 Neuroscience Meeting Planner*. Washington, DC: Society for Neuroscience, 2017. Online.

Alessandro C., Barroso F., Tresch M. (2016). **Role of knee joint afferents in rat locomotion.** Program No. 335.15. *2016 Neuroscience Meeting Planner*. San Diego, CA: Society for Neuroscience, 2016. Online.

Data

15/09/2020

Luogo

Milano