

Andrea Bandini, PhD

EDUCATION/ TRAINING

| INSTITUTION AND LOCATION | DEGREE | COMPLETION DATE MM/YYYY | FIELDS OF STUDY |
|---|--------|----------------------------|------------------------|
| Università di Bologna (Italy) | PhD | 05/2016 | Bioengineering |
| Università degli Studi di Firenze (Italy) | MASc | 11/2012 | Biomedical Engineering |
| Università degli Studi di Firenze (Italy) | BASc | 04/2010 | Electronic Engineering |

A. Research Statement

My research focuses on neurological diseases and aging, and lies at the intersection of computer vision, biomedical signal processing, and rehabilitation engineering. Since the beginning of my graduate studies, I have pursued a set of integrated activities for research, teaching, and service in biomedical engineering focusing on the translation of novel technologies to healthcare, to optimize and personalize treatments through improved assessment of neurological disorders. Geographical distances between patients and clinics/hospitals create barriers towards obtaining optimal assessments and rehabilitation outcomes. Moreover, the bulk of clinical assessments in neurological disorders still rely on perceptual evaluations that may be prone to subjectivity and errors. Modern technologies, in the form of multi-modal and intelligent tools for remote monitoring of motor signs associated with neurological disorders, can help support and complement the clinical assessment, providing a richer picture of the evolving conditions of patients living in the community. **The overarching goal of my research is to improve access to healthcare and optimize interventions in people with neurological disorders by developing multi-modal and intelligent tools for remote assessment.**

My current research focuses on motor functions related to communication (oro-facial), swallowing, and chewing, and the function of the upper limbs (ULs) with two specific goals in mind: (1) the automatic assessment of communication and swallowing disorders due to neurological diseases such as Parkinson's disease (PD), amyotrophic lateral sclerosis (ALS), multiple sclerosis (MS), and stroke; and (2) the automatic assessment of UL functions in individuals with cervical spinal cord injury (SCI) and stroke.

B. Positions and Honors

Positions and Employment

2023 - now **Assistant Professor**, Interdisciplinary Research Center "Health Science", Scuola Superiore Sant'Anna, Pisa, Italy
 2021 - now **Adjunct Scientist**, KITE - Toronto Rehab - University Health Network, Toronto, ON, Canada

Previous Appointments

2021 - 2024 **Adjunct Professor**, Department of Information Engineering, Università degli Studi di Firenze
 2021 - 2023 **Postdoctoral Fellow**, The Biorobotics Institute, Scuola Superiore Sant'Anna, Pisa, Italy
 2016 - 2021 **Postdoctoral Fellow**, KITE - Toronto Rehab - University Health Network, Toronto, ON, Canada
 2015 **Visiting Researcher**, INAOE, Mexico
 2014 - 2015 **Visiting Researcher**, INRIA - LORIA, France
 2013 - 2015 **Instructor**, Università degli Studi di Firenze, Italy
 2012 **Intern**, Bioengineering Lab, Università degli Studi di Firenze, Italy

Honors and Career Awards

2021 **Best abstract award (Postdoc competition)** – 9th National Spinal Cord Injury Conference, Toronto, ON, Canada

- 2020 **3rd Place - Best Oral Presentation Award** – 2020 Annual Scientific Meeting of the American Spinal Injury Association (ASIA), New Orleans, LA, USA (Virtual)
- 2020 **People’s Choice Award** – KITE Three Minute Trainee (3MT) Competition, Toronto, ON, Canada (Virtual)
- 2019 **2nd Place Poster Presentation** Committee Award – 8th National Spinal Cord Injury Conference, Niagara Falls, ON, Canada
- 2018 **Certificate of Outstanding Contribution in Reviewing** – Biomedical Signal Processing and Control
- 2018 **Certificate of Outstanding Contribution in Reviewing** – Journal of Communication Disorders
- 2018 **Travel award** for AGE-WELL’s 4th Annual Conference, Vancouver, BC, Canada
- 2018 **Travel award** for the 3rd annual AGE-WELL Summer Institute, Banff, AB, Canada
- 2018 **Best Poster Presentation Award**, Toronto Rehabilitation Institute, University Healthy Network, Canada
- 2017 **Postdoctoral Award in Technology and Aging**, AGE-WELL NCE, Canada
- 2017 **ORT Conference Travel Award** for the 2017 Canadian Stroke Congress, Calgary, AB, Canada
- 2016 **CPSR Trainee Award**, Heart and Stroke Foundation, Canadian Partnership for Stroke Recovery, Canada
- 2013 - 2015 **PhD Scholarship in Bioengineering**, Università di Bologna, Italy
- 2013 **“Renato Mariani” Master’s Degree Award**, AEIT (Italian Association of Electrotechnics, Electronics, Automation, Informatics and Telecommunication), Italy

C. Contribution to Science

Citation Metrics - as of May 2024

| | | |
|-----------|----------------|--------|
| | Google Scholar | Scopus |
| h-index | 19 | 14 |
| i10-index | 28 | - |
| Citations | 1033 | 618 |

Publications (count) - as of May 2024

| | |
|---|----|
| Peer-Reviewed Journal Articles | 26 |
| Peer-Reviewed Journal Abstracts | 3 |
| Peer-Reviewed Full-Length Conference Articles | 20 |

Presentations (count) - as of May 2023

International Conferences

| | |
|----------------------|----|
| Invited Speakers | 3 |
| Oral Presentations | 12 |
| Poster Presentations | 6 |

National and Local Conferences

| | |
|------------------------|---|
| Invited Speakers | 3 |
| Poster Presentations | 9 |
| Invited Research Talks | 5 |

Peer-Reviewed Journal Articles (Selected)*

1. **A. Bandini** and J. Zariffa, “Analysis of the hands in egocentric vision: A survey,” *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 45, no. 6, pp. 6846-6866, 2023.
2. F. Avantageggiato, A. Farokhniaee, **A. Bandini**, C. Palmisano, I. Hanafi, G. Pezzoli, A. Mazzoni, and I. U. Isaias, “Intelligibility of speech in Parkinson's disease relies on anatomically segregated subthalamic beta oscillations,” *Neurobiology of Disease*, vol. 185, 106239, 2023.
3. M. Dousty, **A. Bandini**, P. Eftekhar, D.J. Fleet, and J. Zariffa, “Grasp Analysis in the Home Environment as a Measure of Hand Function After Cervical Spinal Cord Injury,” *Neurorehabilitation and Neural Repair*, vol. 37, no. 7, pp. 466 – 474, 2023. **Co-Author**
4. **A. Bandini**, S. Smaoui, and C. M. Steele, “Automated pharyngeal phase detection and bolus localization in videofluoroscopic swallowing study: Killing two birds with one stone?” *Computer Methods and Programs in Biomedicine*, vol. 225, 107058 2022.
5. **A. Bandini**, P. Gandhi, D. Sutton, and C. M. Steele, “Bolus Texture Testing as a Clinical Method for Evaluating Food Oral Processing and Choking Risk: A pilot study,” *American Journal of Speech-Language Pathology*, vol. 31, no. 6, pp. 2806-2816, 2022.
6. **A. Bandini**, M. Dousty, S. L. Hitzig, B. C. Craven, S. Kalsy-Ryan, and J. Zariffa, “Measuring hand use in the home after cervical spinal cord injury using egocentric video,” *Journal of Neurotrauma*,

*A complete list of my publications can be viewed on my [Google Scholar page](#)

vol. 39, no. 23-24, 2022.

7. **A. Bandini**, S. Rezaei, D. Guarin, M. Kulkarni, D. Lim, M. Boulos, L. Zinman, Y. Yunusova, and B. Taati, "A New Dataset for Facial Motion Analysis in Individuals with Neurological Disorders," *IEEE Journal of Biomedical and Health Informatics*, vol. 25, no. 4, pp. 1111-1119, 2021.
8. J. Wang, P.V. Kothalkar, M. Kim, **A. Bandini**, B. Cao, Y. Yunusova, T.F. Campbell, D. Heitzman, and J.R. Green, "Automatic Prediction of Intelligible Speaking Rate for Individuals with ALS from Speech Acoustic and Articulatory Samples," *International Journal of Speech-Language Pathology*, vol. 20, no. 6, pp. 669-679, 2018.
9. **A. Bandini**, J.R. Green, J. Wang, T.F. Campbell, L. Zinman, and Y. Yunusova, "Kinematic features of jaw and lips distinguish symptomatic from pre-symptomatic stages of bulbar decline in amyotrophic lateral sclerosis," *Journal of Speech, Language, and Hearing Research*, vol. 61, pp. 1118-1129, 2018.
10. **A. Bandini**, S. Orlandi, H.J. Escalante, F. Giovannelli, M. Cincotta, C.A. Reyes-Garcia, P. Vanni, G. Zaccara, and C. Manfredi, "Analysis of facial expressions in Parkinson's disease through video-based -automatic methods," *Journal of Neuroscience Methods*, vol. 281, pp. 7-20, 2017.
11. **A. Bandini**, S. Orlandi, F. Giovannelli, A. Felici, M. Cincotta, D. Clemente, P. Vanni, G. Zaccara, and C. Manfredi, "Markerless analysis of articulatory movements in patients with Parkinson's disease," *Journal of Voice*, vol. 30, no. 6, pp. 766.e1-766.e11, 2016.
12. **A. Bandini**, F. Giovannelli, S. Orlandi, S.D. Barbagallo, M. Cincotta, P. Vanni, R. Chiamonti, A. Borgheresi, G. Zaccara, and C. Manfredi, "Automatic identification of dysprosody in idiopathic Parkinson's disease," *Biomedical Signal Processing and Control*, vol. 17, pp. 47-54, 2015.

Peer-Reviewed International Conference Articles (Selected)*

1. M. Ceradini, M. Lassi, E. Losanno, A. Gontran-Massey, M. Nalin, I. Del Chicca, C. Puttilli, S. Micera, and **A. Bandini**, "Feasibility and accuracy of a dry and wireless EEG helmet for upper limb motor imagery-based brain-computer interfaces," In Proc. *2023 IEEE International Conference on Metrology for Extended Reality, Artificial Intelligence and Neural Engineering (MetroXRINE)*.
2. **A. Bandini**, G. Zecchin, F. Iberite, T. Proietti, S. Micera, and E. Ambrosini, "Feasibility of a portable, wearable, high-density surface EMG device for detecting functional hand-object interactions," In Proc. *2023 IEEE International Conference on Metrology for Extended Reality, Artificial Intelligence and Neural Engineering (MetroXRINE)*.
3. L. Migliorelli, S. Moccia, E. Frontoni, M. Coccia, L. Villani, and **A. Bandini**, "A preliminary study on self-care telemonitoring of dysarthria in spinal muscular atrophy," In Proc. *2023 45th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*.
4. **A. Bandini** and C. Steele, "The Effect of Time on the Automated Detection of the Pharyngeal Phase in Videofluoroscopic Swallowing Studies," In Proc. *2021 43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pp. 3433-3436.
5. **A. Bandini**, M. Dousty, and J. Zariffa, "A wearable vision-based system for detecting hand-object interactions in individuals with cervical spinal cord injury: First results in the home environment," In Proc. *2020 42nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pp. 2159-2162.
6. D. L. Guarin, A. Dempster, **A. Bandini**, Y. Yunusova, and B. Taati, "Estimation of Orofacial Kinematics in Parkinson's Disease: Comparison of 2D and 3D Markerless Systems for Motion Tracking," In Proc. *15th IEEE International Conference on Automatic Face & Gesture Recognition, FG 2020*, pp. 705-708.
7. **A. Bandini**, J. R. Green, B. D. Richburg, and Y. Yunusova, "Automatic detection of orofacial impairment in stroke," in Proc. *Annual Conference of the International Speech Communication Association, INTERSPEECH, 2018*, pp. 1711-1715.
8. **A. Bandini**, J.R. Green, B. Taati, S. Orlandi, L. Zinman, and Y. Yunusova, "Automatic detection of amyotrophic lateral sclerosis (ALS) from video-based analysis of facial movements: speech and non-speech tasks," in Proc. *13th IEEE Conference on Automatic Face and Gesture Recognition, FG 2018*, pp. 150-157.
9. **A. Bandini**, J.R. Green, L. Zinman, and Y. Yunusova, "Classification of bulbar ALS from kinematic features of the jaw and lips: Towards computer-mediated assessment," in Proc. *Annual Conference of the International Speech Communication Association, INTERSPEECH, 2017*, pp. 1819-1823.
10. **A. Bandini**, A. Namasivayam, and Y. Yunusova, "Video-based tracking of jaw movements during speech: Preliminary results and future directions," in Proc. *Annual Conference of the International Speech Communication Association, INTERSPEECH, 2017*, pp. 689-693.

D. Teaching Experience

Academic teaching experience – Graduate courses

- 2024 – Now Scuola Superiore Sant’Anna
Course: Biomechanics of human motion
Program: Master’s degree in bionics engineering
- 2014 Università degli Studi di Firenze, School of Engineering
Course: Biomedical Signal Processing
Program: Master’s degree in biomedical engineering

Academic teaching experience - Undergraduate courses

- 2021 - 2024 Università degli Studi di Firenze, School of Human Health Sciences
Course: Data processing and biomedical signals
Program: Bachelor’s degree in techniques of neurophysiology

E. Additional Information

Research Funding

- 2024 – 2026 **Principal Investigator.** “MIMOSA – Multimodal Intelligent Methods for Orofacial and Speech Assessment to predict ALS bulbar decline”. *Fondazione AriSLA – 2023 Call for Applications for ALS research projects*, Co-Investigator: Gabriele Siciliano. 120,000 EUR.
- 2022 – 2026 **Co-Investigator.** “My Voice Library”. *National Health and Medical Research Council (NHMRC, Australia) – 2021 Ideas Grants*. PI: Petra Karlsson, Co-Investigators: Alistair McEwan, Michelle McInerney, Juanitam Graham, Hayley Smithers Sheedy, Silvia Orlandi. \$914,371 AUD.
- 2021 **Co-applicant.** “WHALE – Wearable HAnd function anaLysis through Egocentric Video”. *Praxis Spinal Cord Institute – The Spinal Cord Rehab Innovation Challenge*. \$100,000 CAD.
- 2018 - 2020 **Collaborator.** “Improving facial tracking technology for the assessment of orofacial deficits and their recovery after stroke”. *Heart and Stroke Foundation, Canadian Partnership for Stroke Recovery – CPSR collaborative innovation grant*. \$50,000 CAD (top-ranked grant in the competition – distinction as the 2018 Dr. Tony Hakim Stroke Innovation Award).
- 2017 - 2019 **PI.** “Healthy Face”. *AGE-WELL NCE – Postdoctoral Award in Technology and Aging 2017*. \$45,000 CAD.
- 2016 - 2017 **PI.** “Markerless facial tracking for speech rehabilitation”. *Heart and Stroke Foundation, Canadian Partnership for Stroke Recovery – CPSR Trainee Award*. \$25,000 CAD.
- 2014 - 2016 **Co-Is.** “Analysis and classification techniques of voice and facial expressions: application to neurological diseases in newborns and adults”. *Italian Ministry of Foreign Affairs – Joint scientific and technological research projects between Italy and the United States of Mexico (2015-2016)*. 8.920 EUR.

Contributions to Training as Co-supervisor and Mentor (Count)

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|-------------------|----|
| PhD Students | 5 |
| Graduate Students | 11 |
| Undergraduates | 10 |

Peer-Review Activities

Editorial Boards

- 2020 - 2022 **Guest Editor**, Special Issue “Biomedical Signal and Image Processing in Speech Analysis”, *Sensors*

Grants

- 2022 - 2023 **Invited Grant Reviewer**, Czech Health Research Council (AZV ČR)
- 2020 **Invited Grant Reviewer**, Dutch Research council (NWO) and the Netherlands Organization for Health Research and Development (ZonMw)

International Journals

- 2015 - present **Reviewer** for several journals (IEEE Journal of Biomedical and Health Informatics, IEEE Transactions on Industrial Electronics, IEEE Transactions on Affective Computing, IEEE Transactions on Biomedical Engineering, IEEE Open Journal of Engineering in Medicine and Biology, Medical & Biological Engineering & Computing, Medical Engineering & Physics, Biomedical Signal Processing and Control, Journal of Communication Disorders, Speech Communication, Journal of Speech Language and Hearing Research, etc.) and conferences (IEEE EMBC, Interspeech, IEEE conference series on Automatic Face and Gesture Recognition, etc.)
- Review Panels*
2017 - 2021 **Presentation Judge** during research days at the Institute of Biomedical Engineering, University of Toronto, Canada

Professional Licences, Activities, Memberships

Licences

2014 **Qualified Engineer**, Italian Professional Engineering License (Industrial Engineering)

Conference and Advisory Committees

- 2023 **Co-organizer - Mini-symposium** "Speech science for healthcare applications: databases and technologies to support and restore speech functions," 45th Annual conference of the IEEE Engineering in Medicine and Biology Society (EMBC2023), Sydney, Australia
- 2020 **Co-organizer - Special Session** "Face and Body Movement Analysis – Applications in Healthcare," 15th International Conference on Automatic Face and Gesture Recognition, Buenos Aires, Argentina.
- 2018 - 2019 **Ontario Regional Representative**, AGE-WELL HQP Advisory Committee
- 2015 **Co-organizer - Conference Committee**, 11th PAN-European Voice Conference, Firenze, Italy.
- 2015 **Co-organizer - Conference Committee**, 9th International Workshop on Models and Analysis of Vocal Emissions for Biomedical Applications, Firenze, Italy.

Professional Memberships

- 2022 - present **Member**, Gruppo Nazionale di Bioingegneria (GNB)
- 2015 - present **Member**, Institute of Electrical and Electronics Engineers (IEEE)
- 2015 - present **Member**, IEEE Engineering in Medicine and Biology Society (EMBS)
- 2019 - present **Member**, Canadian Spinal Cord Injury Rehabilitation Association (CSCIA-RA)
- 2015 - 2020 **Member**, International Speech Communication Association (ISCA)
- 2017 - 2019 **Highly Qualified Personnel (HQP)**, AGE-WELL NCE
- 2016 - 2017 **Trainee**, Canadian Partnership for Stroke Recovery (CPSR)

Major Collaborations

- Prof. Catriona M. Steele AI for chewing and swallowing analysis. KITE Research Institute (Canada)
- Prof. José Zariffa Egocentric vision for upper limb assessment. University of Toronto (Canada)
- Prof. Yana Yunusova Automatic orofacial assessment in ALS. University of Toronto (Canada)
- Prof. Gabriele Siciliano Automatic assessment of bulbar ALS. University of Pisa (Italy)
- Dr. Hugo Jair Escalante Computer vision techniques for facial motion analysis. INAOE (Mexico)
- Dr. Silvia Orlandi Automatic speech and voice analysis. University of Bologna (Italy)

Languages

- Italian Native
- English Fluent
- French Intermediate