

## 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 **Affiliate Scientist**, KITE - Toronto Rehab - University Health Network, Toronto, ON, Canada  
 2021 - now **Adjunct Professor**, Department of Information Engineering, Università degli Studi di Firenze

#### *Previous Appointments*

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 **3<sup>rd</sup> 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 February 2023

	Google Scholar	Scopus
h-index	17	12
i10-index	22	-
Citations	713	410

#### Publications (count) - as of February 2023

Peer-Reviewed Journal Articles	22
Peer-Reviewed Journal Abstracts	3
Peer-Reviewed Full-Length Conference Articles	14
Peer-Reviewed Conference Abstracts	35

#### Presentations (count) - as of October 2022

##### *International Conferences*

Invited Speakers	3
Oral Presentations	11
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**, 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.
2. **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.
3. **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*, vol. 39, no. 23-24, 2022.
4. **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.
5. **A. Bandini** and J. Zariffa, "Analysis of the hands in egocentric vision: A survey," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2020.
6. 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.
7. **A. Bandini**, J.R. Green, J. Wang, T.F. Campbell, L. Zinman, and Y. Yunusova, "Kinematic features

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

- 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.
8. **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.
  9. **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.
  10. **A. Bandini**, F. Giovannelli, S. Orlandi, S.D. Barbagallo, M. Cincotta, P. Vanni, R. Chiaramonti, 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. **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.
2. **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.
3. 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.
4. **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.
5. **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. *13<sup>th</sup> IEEE Conference on Automatic Face and Gesture Recognition, FG 2018*, pp. 150-157.
6. **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.
7. **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. DOI: 10.21437/Interspeech.2017-1371

#### **D. Teaching Experience**

##### **Academic teaching experience - Undergraduate courses**

2021 - now    *Role:* Adjunct professor  
Università degli Studi di Firenze, School of Human Health Sciences  
*Course:* Data processing and biomedical signals  
*Program:* Techniques of Neurophysiology

##### **Academic teaching experience – Graduate courses**

2014        *Role:* Teaching assistant/Instructor  
Università degli Studi di Firenze, School of Engineering  
*Course:* Biomedical Signal Processing  
*Program:* Biomedical Engineering (graduate students)

#### **E. Additional Information**

##### **Research Funding**

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)**

PhD Students	2
Graduate Students	10
Undergraduates	10

### **Peer-Review Activities**

#### *Editorial Boards*

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

#### *Grants*

2022 **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 2021, Interspeech 2021, IEEE FG2020, 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*

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*

2015 - present	<b>Member</b> , Institute of Electrical and Electronics Engineers (IEEE)
2015 - present	<b>Member</b> , IEEE Engineering in Medicine and Biology Society (EMBS)
2019 - present	<b>Member</b> , Canadian Spinal Cord Injury Rehabilitation Association (CSCIA-RA)
2015 - 2020	<b>Member</b> , International Speech Communication Association (ISCA)
2017 - 2019	<b>Highly Qualified Personnel (HQP)</b> , AGE-WELL NCE
2016 - 2017	<b>Trainee</b> , 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)
Dr. Massimo Cincotta	Remote assessment of neurological conditions. USL Toscana Centro (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