

JAEHYUN BAE

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CURRENT POSITION

Harvard University 2013 –Present
PhD candidate in Material Science & Mechanical Engineering
Thesis title: Soft exosuits for paretic ankle assistance in walking after stroke
Research advisor: Conor J. Walsh
Cambridge, MA

EDUCATION

Harvard University 2013 - Expected Feb 2019
Doctor of Philosophy, Material Science & Mechanical Engineering
Cambridge, MA

Stanford University 2011 - 2013
Master of Science, Mechanical Engineering
Stanford, CA

Seoul National University 2005 - 2009
Bachelor of Science, *Summa cum laude*, Mechanical Engineering
Seoul, South Korea

ACADEMIC ACHIEVEMENTS AND AWARDS

Best Paper Award in Medical Robotics, 2018
IEEE International Conference of Robotics and Automation (ICRA)

Innovation Award, French Arthritis Foundation (Fondation Arthritis) 2017

Finalist for Best Poster Award, 2017
International Symposium on Wearable Robotics (WeRob)

Kwanjeong Scholarship, Kwanjeong Educational Foundation 2013 - 2017

Runner-up for Best Conference Paper Award, 2015
IEEE International Conference of Rehabilitation Robotics (ICORR)

John A. and Elizabeth S. Armstrong Innovation Fund, Harvard University 2014 - 2015

Samsung Scholarship, Samsung Scholarship Foundation 2011 - 2013

Stanford Engineering Graduate Fellowship, Stanford University 2011 - 2012

Top Graduating Student Honor, Seoul National University School of Engineering 2009

Best Presentation Award for Bachelor Thesis, Seoul National University 2008

Silver prize, Electrical Engineering competition at Seoul National University 2008

Merit-based Scholarship, Seoul National University 2007 - 2008

Science and Engineering Scholarship, Korea Student Aid Foundation 2006 - 2007

Bronze Prize, Nationwide Engineering Mathematics Olympiad, Korean Math Society 2007

RESEARCH EXPERIENCE

Neuromotor Recovery lab, Boston University Jun 2018 - Present
Visiting researcher, Principal investigator: Louis N. Awad
Boston, MA

- Conducted clinical studies to evaluate the efficacy of gait training with soft exosuit

Biodesign lab, Harvard University Sep 2013 - Present
Research assistant, Advisor: Conor J. Walsh
Cambridge, MA

- Developed multiple soft wearable robots (soft exosuits) to assist with walking after stroke
 - Designed and conducted hundreds of experiments involving more than 20 chronic stroke survivors
 - Analyzed biomechanics data in healthy and poststroke walking
 - Collaborated with Rewalk Robotics (NASDAQ: RWLK) to translate exosuit technology to real-world clinics
- Stanford Robotics lab, Stanford University** 2012 – 2013
Research assistant, Advisor: Oussama Khatib Stanford, CA
- Conducted simulation studies of human motion based on task-space operation control framework
- CHARM lab, Stanford University** 2012
Research assistant, Advisor: Allison M. Okamura Stanford, CA
- Developed a wearable haptic device for upper extremity posture correction
- Automotive lab, Seoul National University** 2009
Undergraduate Research assistant, Advisor: Kyoungdoug Min Seoul, South Korea
- Validated efficacy of CO2 sensors using non-dispersive Infrared absorption technique

TEACHING EXPERIENCE

- Harvard University** 2015
Teaching Fellow, Mechanical Systems (ES125) Cambridge, MA
- Stanford University** 2012
Teaching Assistant, Introduction to Robotics (CS223A) Stanford, CA
- Seoul National University** 2008
International student tutor, Calculus 2 Seoul, South Korea

PUBLICATIONS

Refereed journal papers

Bae J.; Awad L.N.; Long A.; O'Donnell K.; Hendron K.L.; Holt K.G.; Ellis T.D.; Walsh C.J.; "Biomechanical mechanisms underlying exosuit-induced improvement in walking economy after stroke", *Journal of Experimental Biology*, *jeb.168815*, 2018

Awad L.N.*; **Bae J.***; O'Donnell K.; De Rossi S.M.M.; Hendron K.L.; Sloop L.H., Kudzia P.; Allen S.; Holt K.G.; Ellis T.D.; Walsh C.J.; "A soft robotic exosuit improves walking in patients after stroke", *Science Translational Medicine*, *Vol 9*, *eaai9084*, 2017 (*: **Equal contribution**)

Awad L.N.; **Bae J.***; Kudzia P.*; Long A.; Hendron K.L.; Holt K.G.; O'Donnell K.; Ellis T.D.; Walsh C.J.; "Reducing Circumduction and Hip Hiking During Hemiparetic Walking Through Targeted Assistance of the Paretic Limb Using a Soft Robotic Exosuit", *American Journal of Physical Medicine and Rehabilitation*, *96*, *S157-S164*, 2017 (*: **Equal contribution**)

Ding Y.; Galiana I.; Asbeck A.T.; De Rossi S.M.M.; **Bae J.**; Santos T.R.; De Araujo V.; Lee S.; Holt K.G.; Walsh C.J.; "Biomechanical and physiological evaluation of multi-joint assistance with soft exosuit", *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, *Vol 25*, *Issue 2*, 2017

Bae J.; Lee J.; Malley M.; Gafford J.; Holland D.; Vogt D.; Mengüç Y.; Bean J.; Walsh C.J.; "A Soft, Wearable, Quantitative Ankle Diagnostic Device", *ASME Journal of Medical Devices*, *Vol 9(3)*, *030905-030905-3*, 2015

Refereed conference papers

Bae J.; Siviyy C.; Rouleau M.; Menard N.; O'Donnell K.; Galiana I.; Athanassiu M.; Ryan D.; Bibeau C.; Sloop L.; Kudzia P.; Awad L.N.; Ellis T.D.; Walsh C.J.; "A lightweight and efficient portable soft exosuit for paretic ankle assistance in walking after stroke", *Proceedings in the International Conference on Robotics and Automation (ICRA)*, 2018 (**Best Paper Award in Medical Robotics**)

Bae J.; De Rossi S.M.M.; O'Donnell K.; Hendron K.L.; Awad L.N.; Santos T.R.; Araujo V.; Ding Y.; Holt K.G.; Ellis T.D.; Walsh C.J.; "A soft exosuit for patients with stroke: Feasibility study with a mobile off-board actuation

unit”, *Proceedings in International Conference on Rehabilitation Robotics (ICORR)*, 2015 (**Runner-up for Best Conference Paper Award**)

Refereed conference abstracts

Sloot L.H.; **Bae J.**; Baker L.; O’Donnell K.; Menard N.; Porciuncula F.; Choe D.; Ellis T.D.; Awad L.; Walsh C.J.; A soft robotic exosuit assisting the paretic ankle in patients post-stroke: Effect on muscle activation during overground walking, *World Congress of Biomechanics*. Dublin, Ireland. 2018

Awad L.N.; **Bae J.**; O’Donnell K.; Hendron K.; Sloot L.H.; Siviyy C.; Kudzia P.; Ellis T.D.; Walsh C.J.; “Soft Exosuits Increase Walking Speed and Distance after Stroke”, *International Symposium on Wearable Robotics (WeRob)*, Houston, TX, 2017 (**Finalist for Best Poster Award**)

Bae J.; Awad L.N.; O’Donnell K.; De Rossi S.M.M.; Hendron K.; Sloot L.H.; Kudzia P.; Holt K.G.; Ellis T.D.; Walsh C.J.; “Exosuit-induced improvements in walking after stroke: comprehensive analysis on gait energetics and biomechanics”, *International Symposium on Wearable Robotics (WeRob)*, Houston, TX, 2017.

Kudzia P.; **Bae J.**; Awad L.N.; Long A.; Sloot L.H.; Hendron K.; Holt K.G.; O’Donnell K.; Ellis T.D.; Walsh C.J.; “A uni-lateral soft exosuit for the paretic ankle can reduce gait compensations in patients post-stroke”, *41th Annual Meeting of the American Society of Biomechanics (ASB)*, Boulder, CO, 2017

Sloot L.H.; Hejrati B.; Kudzia P.; **Bae J.**; Hendron K.; O’Donnell K.; Holt K.G.; Awad L.N.; Walsh C.J.; “A unilateral ankle assisting soft robotic exosuit can improve post-stroke gait during overground walking”, *41th Annual Meeting of the American Society of Biomechanics (ASB)*, Boulder, CO, 2017

Awad L.N.; **Bae J.**; O’Donnell K.; Hendron K.; Kudzia P.; Zurawski E.; Holt K.; Ellis T.D.; Walsh C.J.; “Soft Wearable Robots Can Increase Walking Speed and Distance After Stroke: Proof of Concept”, *Combined Sections Meeting of the American Physical Therapy Association (APTA CSM)*, San Antonio, TX, 2017

Awad L.N.; **Bae J.**; O’Donnell K.; De Rossi, S.M.M.; Hendron K.; Holt K.G.; Ellis T.D.; Walsh C.J.; “A soft exosuit for assisting poststroke walking”. *9th World Congress of Neurorehabilitation (WCNR)*, Philadelphia, PA, 2016

Bae J.; Awad L.N.; O’Donnell K.; Hendron K.; Allen S.; De Rossi S.M.M.; Holt K.G.; Ellis T.D.; Walsh C.J.; “Assisting paretic ankle motion with a soft exosuit can reduce whole-body compensatory gait patterns and improve walking efficiency for patients after stroke”, *Dynamic Walking*, Holly MI, 2016

Awad L.N.; **Bae J.**; De Rossi S.M.M.; O’Donnell K.; Hendron K.; Holt K.G.; Ellis T.D.; Walsh C.J.; “Soft Wearable Robots Can Reduce the Energy Cost of Poststroke Walking: A Proof-of-Concept Study”, *Combined Sessions Meeting of the American Physical Therapy Association (APTA CSM)*, Anaheim, CA, 2016

De Rossi S.M.M.; **Bae J.**; O’Donnell K.; Hendron K.; Holt K.G.; Ellis T.D.; Walsh C.J.; “Gait improvements in stroke patients with a soft exosuit”, *Proceedings of Gait and Clinical Movement Analysis Society (GCMAS)*, 2015

PATENTS

De Rossi S.M.M.; O’Donnell K.; **Bae J.**; Asbeck A.T.; Holt K.G.; Walsh C.J.; “Assistive flexible suits, flexible suit systems, and methods for making and control thereof to assist human mobility”, *WO 2015088863 A3*, 2015

PRESENTATIONS

“Soft exosuit for paretic ankle assistance in walking after stroke”, Hyundai Global Top Talent Forum, San Diego, CA, 2018

“Soft exosuit for paretic ankle assistance in walking after stroke”, US-Korea Conference on Science, Technology, and Entrepreneurship, Queens, NY, 2018

“Preliminary study of autonomous soft exosuit for paretic ankle assistance after stroke in overground walking”, *Dynamic Walking conference*, Pensacola, FL, 2018

“Exosuit-induced improvements in walking after stroke: comprehensive analysis on gait energetics and biomechanics”, *International Symposium on Wearable Robotics (WeRob)*, Houston, TX, 2017

“Soft exosuit for Poststroke gait training”, *BK21 invited lecture at Sogang University, Seoul, South Korea*, 2017
“Soft exosuit for gait recovery after stroke: Feasibility study with Chronic poststroke patients”, *Spaulding Stroke Recovery Research Symposium, Charlestown, MA*, 2016
“Assisting paretic ankle motion with a soft exosuit can reduce whole-body compensatory gait patterns and improve walking efficiency for patients after stroke”, *Dynamic Walking conference, Holly MI*, 2016
“A soft exosuit for patients with stroke: Feasibility study with a mobile off-board actuation unit”, *International Conference on Rehabilitation Robotics (ICORR). Singapore*, 2015

SELECTED MEDIA COVERAGES

“Soft wearable robotic suit promotes normal walking in stroke patients, opening new approaches to gait re-training and rehabilitation”, *ScienceDaily*, 2017
“Foundational Study Shows Soft Suit Exoskeleton Improves Walking for Stroke Survivors”, *Business Insider*, 2017
“Robotic exosuits could help stroke sufferers walk again after experiencing the ‘brain attack’”, *DailyMail*, 2017
“Robotic Exoskeleton May Help Stroke Survivors Walk Again”, *NeurologyNow*, 2017
“Neurotech: Robotic Assist Devices Show Gains in Walking for Crouch Gait in Cerebral Palsy and Post-Stroke Hemiparesis”, *Neurology Today*, 2017
“Soft Wearable Exosuit Helps Stroke Patients to Walk”, *MedGadget*, 2017
“Robotic exosuit will get stroke victims back into their stride”, *The Sunday Times*, 2017
“Robotic Exosuit Improves Walking After Stroke”, *Medscape*, 2017
“Soft Robotic Exosuit Can Help Stroke Patients”, *IEEE Spectrum*, 2017
“Robotic suit promotes normal walking in stroke patients”, *Harvard Gazette*, 2017
“ReWalk Robotics shows off a soft exosuit designed to bring mobility to stroke patients”, *TechCrunch*, 2017
“Soft robotics needs the same breakthrough rigid robots had in the 1980s”, *Silicon Republic*, 2017
“This new robotic suit could help millions of stroke victims walk again”, *Yahoo Finance*, 2017
“Exo-stential powers: How a wearable robot will help people walk again”, *Wareable*, 2016
“The robot suit providing hope of a walking cure”, *The Guardian*, 2016

ACADEMIC SERVICE

Journal reviewer: American Journal of Physical Medicine & Rehabilitation; Archives of Physical Medicine and Rehabilitation; IEEE Transactions on Biomedical engineering; International Journal of Control, Automation and Systems

Conference paper reviewer: IEEE ICORR; IEEE IROS; IEEE BioRob

SKILLS

Language: Korean, English

Programming language: C programming, C++, Matlab, Python

Research tools: Biomechanics analysis (Vicon, Qualisys, Visual3d, OpenSim), Mechatronics (ATMEL, Arduino, LabView), 3-D graphics (OpenGL), CAD (Solidworks), Mathematical analysis (Mathematica)