Christian I. Peñaloza

Curriculum Vitae

- named "Innovator of the Year" by MIT Technology Review's Innovators Under 35 Mexico 2016 Magazine

Education

2014 **Ph.D., Engineering Science**, *Osaka University*, Japan.
Graduate minor: *Cognitive Neuroscience Robotics*

2011 **Masters, Engineering Science**, *Osaka University*, Japan.
Specialized in Robotics and Systems Innovation

2008 **B.S. Computer Engineering**, *San Diego State University*, USA.

Professional Appointments

Academia

2015-Present **Research Scientist**, *Advanced Telecommunications Research Institute (ATR)*, Japan.

- Current research involves machine learning and cognitive neuroscience applied to Brain Computer Interfaces (BCI) and Robotics.
- Implementation of Deep Learning algorithms to improve classification of EEG-based commands to be performed by Geminoid HI-2 android robot.
- Development of scientific techniques to control human augmentation devices using brain signals.
- Propose and evaluate research projects in the areas of robotics, artificial intelligence, neuroscience, computer vision, bioengineering and human augmentation technologies.

2015-Present **Research Faculty**, *Intelligent Robotics Laboratory, Osaka University*, Japan.

- Co-advice Bachelor's and Master's students' thesis in topics such as machine learning, brain signal processing and robotics.

2012–2014 **Graduate Research Assistant**, *Osaka University*, Japan.

Industry

07-08/2010 **AI Research Intern**, *Toshiba Research and Development Center*, Kawasaki, Japan.

- Conducted research and implementation of Face Attribute Classifiers for artificial intelligent system to recognize the presence/absence of particular facial traits.
- Designed a Real Time Face Attribute Recognition Interface to demonstrate the applicability of this research.

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04-08/2009 **Engineering Intern**, *TUV Rheinland*, Osaka, Japan.

- Conducted studies and performed analysis on software safety procedures for FPGA - ASIC design according to the international standard IEC 61508.
- Developed hardware design algorithms in VHDL, and performed successful simulations and synthesis.

01-04/2009 **Software Engineering Intern**, *Panaxion Inc.*, Montreal, Canada.

- Completed full Software Requirements Specification document and designed diagrams in UML format.
- Prepared requirements and design specifications, determining input/output processes, coordinated design of subsystems and integration of total system.
- Completed full graphic design & code implementation of software user Interface.

Awards

2018 "Excellence Research"' award - Advanced Telecommunications Research Institute International, Kyoto, Japan.

2016 "Innovator of the Year"' award - MIT Technology Review's Innovators Under 35 Mexico 2016.

2014 Incentive Award for Overseas Research Presentation, Manufacturing and Technology Association - Osaka University, Osaka, Japan.

2013 Social Innovation Award (1st place winner), Osaka University San Francisco Center for Education and Research, San Francisco, CA. USA

2013 First Look Venture Assessment Team Project Award (1st place winner) The 3rd Global Technology Entrepreneurship and Commercialization Course, Osaka.

2013 Worldwide Cloud Robotics Hackathon (1st place winner) (online competition)

2012 Japanese Government Scholarship Recipient (MEXT), Osaka, Japan

2010 Murata Overseas Scholarship Academic Award, Osaka, Japan.

2009 Japan Student Services Organization Scholarship (JASSO), Osaka, Japan.

2009 National Outstanding Website Award - Texas, USA.

2008 National Business Association Distinguished Scholar Award - Las Vegas, USA.

2008 Deloitte Scholarship Recipient - Emerging Professional Student Award, Las Vegas, NV, USA.

Technical skills

OS Linux, Windows

Languages C, C++, C#, Java, PYTHON, HTML, LaTeX

Environments Matlab, .NET Visual Studio, Robot Operating System (ROS)

Libraries TensorFlow, Caffe, OpenCV, Boost, LibSVM, Accord.NET

Languages

Spanish **Mothertongue**

English **Native Level**

Japanese **Business Level**

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Research Areas

- Machine Learning
- Systems Integration
- Cognitive Neuroscience
- Human Robot Interaction
- Educational Robotics
- Deep Learning
- Computer Vision
- Brain Machine Interface
- Android robots
- Human Augmentation

Courses Taught

Three-credit courses at PUCP were taught via video-conference from Japan.

Year	Course	Institution
Fall 2014	Introduction to Computer Vision & Machine Learning	PUCP
Spring 2015	Introduction to Computer Vision & Machine Learning	PUCP

Undergraduate Project Advising

2018 David Carmona (ITS Poza Rica), Project title: *Multimodal Deep Learning approach for Neuro-visual data reconstruction*

2017 Bruno Senzio-Savino (Osaka University), Project title: *Supernumerary Robotic Limb controlled by a Brain-Machine Interface*

2016 Kinoshita Fuma (Osaka University), Project title: *Effect of Haptic Feedback in Brain-Computer Interfaces*

2016 Kodai Shatani (Osaka University), Project title: *Detection of Error Potentials to Increase Brain-Computer Interface Performance*

2016 Fred Achic Alarcon (PUCP), Thesis: *Hybrid BCI System to Operate an Electric Wheelchair and a Robotic Arm for Navigation and Manipulation Tasks*

2015 Jose Alexander-Lopez (PUCP), Thesis: *External Module with a Depth Sensor for Humanoid Robots and its application to improving human robot interaction*

Research Funding

Awarded

- Multimodal Deep Learning Framework for Brain Computer Interface Systems, (Principal Investigator) 2017-2019 from JSPS-Kakenhi: 5,000,000yen (45,000 USD)
- Incorporating Deep Learning and Error Potential Feedback to a BMI System to Enhance User Experience, (Principal Investigator) 2015-2016 from JSPS-Kakenhi: 1,430,000yen (12,000 USD)
- Design and Implementation of a Mechatronic SmartBed for Improved Rehabilitation, (Co-Principal Investigator) 2014-2015 from Concytec, Peru: 64,000 peruvian sol (18,000 USD)
- Object Segmentation and successive modeling using Human Action Observation, (Co-Principal Investigator) 2011-2013 from JSPS-Kakenhi: 1,230,000yen (10,000 USD)

Under Review

- Hybrid Robotic Wheelchar controlled by a Brain Machine Interface for Patients with Motor Paralysis Conditions, (Co-Principal Investigator) 2019-2021 from CONACYT-SRE: 5,000,000mxn (273,000 USD)
- Clinical Study of Neurorehabilitation with a Brain-Controlled Exoskeleton and its Effects in Neuroplasticity , (Co-Principal Investigator) 2019-2021 from CONACYT-SEP: 5,000,000mxn (273,000 USD)
- Intelligent Breast Cancer Prevention System and its applicability to Primary Medical Services, (Co-Principal Investigator) 2019-2021 from CONACYT-SRE: 5,000,000mxn (273,000 USD)
- Intelligent Recommendation System for Entrepreneurship and Innovation Education, (Co-Principal Investigator) 2019-2021 from CONACYT-SRE: 5,000,000mxn (273,000 USD)
- Robotic Assistante for Basic Education in Mexico, (Co-Principal Investigator) 2019-2021 from CONACYT-SRE: 5,000,000mxn (273,000 USD)

Publications

Patents

P1 **Penaloza, C.**, Shuichi Nishio 2018. BMI control of a third arm for multitasking. Japanese patent application no. 2018-032967, filed January 2018. Patent pending.

P2 **Penaloza, C.**, Cuellar, F. (PUCP) 2016. Automatic Wheelchar with Robotic Manipulation and Brain Machine Interface. Int. Classification of Patent C.I.P. 8 A61B 5/0476; A61G 5/10, filed January 2016. Patent awarded.

Book Chapters

B1 **Christian I. Penaloza**, Shuichi Nishio, and Hiroshi Ishiguro: "Towards Brain-Controlled Android Robots - From Science Fiction to Reality", GIS-Global (under publication)

B2 **Christian I. Penaloza**, Cesar Lucho, and Francisco Cuellar: "Towards the Design of Robots inspired in Ancient Cultures as Educational Tools" Springer LNAI State-of-the-Art Survey book: Cultural Robotics. Vol.9549 of the series Lecture Notes in Computer Science pp 78-84

Journal Articles

J1 **Christian I. Penaloza** and Shuichi Nishio. Science Robotics, Vol. 3, Issue 20, eaat1228 (2018), DOI: 10.1126/scirobotics.aat1228.

J2 **Christian I. Penaloza**, M. Alimardani and S. Nishio, "Android Feedback-based Training modulates Sensorimotor Rhythms during Motor Imagery," in IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. PP, no. 99, pp. 1-1. .

J3 **Christian I. Penaloza**, Yasushi Mae, Masaru Kojima and Tatsuo Arai: "Brain Signal based Safety Measure Activation for Robotic Systems", Advanced Robotics, Vol. 29, No. 19, 2015.

J4 **Penaloza, C.I.**; Mae, Y.; Cuellar, F.F.; Kojima, M.; Arai, T., "Brain Machine Interface System Automation Considering User Preferences and Error Perception Feedback," in Automation Science and Engineering, IEEE Transactions on , vol.11, no.4, pp.1275-1281, Oct. 2014

J5 **Christian I. Penaloza**, Yasushi Mae, Kenichi Ohara, Tomohito Takubo and Tatsuo Arai: "Web-enhanced object category learning for domestic robots", Intelligent Service Robotics, Springer-Verlag ISSN.1861-2776, pp.1-15, 2012.

Refereed Conferences

C1 **Christian Penaloza**, David Hernandez-Carmona, and Shuichi Nishio. 2018. Towards Intelligent Brain Controlled Robotic Limbs. In Proceedings of the 2018 IEEE International Conference on Systems, Man, and Cybernetics (SMC2018), Miyazaki,Japan, October 7-10, 2018.

C2 Masa Jazbec, Shuichi Nishio, Hiroshi Ishiguro, Masataka Okubo, and **Christian Penaloza**. 2017. Body-swapping Experiment with an Android: Investigation of the Relationship Between Agency and a Sense of Ownership toward a different Body. In Proceedings of the Companion of the 2017 ACM/IEEE International Conference on Human-Robot Interaction (HRI '17). ACM, New York, NY, USA, 143-144.

C3 Kodai Shatani, **Christian I. Penaloza**, Shuichi Nishio, "Detecting error-related negativity while operating Android with BMI", The 30th Annual Conference of the Japanese Society for Artificial Intellitgence (JSAI 2016) , ref.1I5-3, Kitakyushu, Japan. June 6-9, 2016.

C4 Fred Achic Alarcon, Jhon Ezrad Montero FernÃąndez, **Christian Penaloza**, Francisco Cuellar: "Hybrid BCI System to Operate an Electric Wheelchair and a Robotic Arm for Navigation and Manipulation Tasks",IEEE International Workshop on Advanced Robotics and its Social Impacts(ARSO2016),Shanhai, China, July 7-10,2016.

C5 Bruno Senzio-Savino, Mohammad Reza Alsharif, Carlos E. Gutierrez, **Christian Penaloza**, Katsumi Yamashita: " Brain Wave Pattern Classification from Virtual Training Environment by Self-Organizing Maps", The 31st International Technical Conference on Circuits/Systems, Computers and Communications (ITC-CSCC 2016),Okinawa, Japan July 10-13, 2016.

C6 Eiji Onchi, **Christian Penaloza**, Francisco Cuellar: "Design and Implementation of a Mechatronic SmartBed for Improved Rehabilitation",IEEE International Conference on Industrial Technology (ICIT2016),Taipei, Taiwan, Mach 14-17,2016

C7 **C. Penaloza**, Yasushi Mae, Masaru Kojima, and Tatsuo Arai: "BMI-based Framework for Teaching and Evaluating Robot Skills", IEEE International Conference on Robotics and Automation (ICRA 2014), Hong Kong, China. May 31 -June 7, 2014.

C8 Francisco Cuellar, **Christian I. Penaloza**, Pedro Garret, David Olivo, Miriam Mejia, Nancy Valdez, Agueda Mija: "Robotics Education Initiative for Analyzing Learning and Child-Parent Interaction", 2014 Frontiers in Education Conference (FIE 2014), Madrid, Spain, October 22-25, 2014.

C9 **Christian I. Penaloza**,Yasushi Mae, M. Kojima, M. Horade, K. Kamiyama and Tatsuo Arai: "Robot Social Imitation by Observation of Human Behaviors", Proceedings of the 32th Annual Conference of the Robotics Society of Japan, Kyushu, Japan, September 4-6, 2014.

C10 Fabio DallaLibera, **Christian I. Penaloza**, Yuichiro Yoshikawa and Hiroshi Ishiguro: "Kinematic Analysis of a 3D Printable 4-DOF Desktop Robot Actuated Exclusively by Revolute Pairs", The 13th International Conference on Intelligent Autonomous Systems (IAS 2014). Padova, Italy. July. 18, 2014.

C11 **Christian I. Penaloza**, Y. Mae, M. Kojima, M. Horade, K. Kamiyama and T. Arai, "Anomaly Detection using User's EEG signals", JSME Robotics and Mechatronics Conference (ROBOMEC) , Toyama Japan. May 25-29, 2014

C12 **C. Penaloza**, Yasushi Mae, Kenichi Ohara, and Tatsuo Arai: "BMI-based Learning System for Appliance Control Automation", IEEE International Conference on Robotics and Automation (ICRA 2013), Karlsruhe, Germany. May 6 - 10, 2013.

C13 **Christian I. Penaloza**, Yasushi Mae, Francisco Cuellar, Masaru Kojima and Tatsuo Arai: "Ambient Intelligence by Learning from Appliance Tele-operation and sensing using BMI", Proceedings of the 31st Annual Conference of the Robotics Society of Japan, Tokyo, Japan, September 4-6, 2013

C14 Francisco Cuellar, Dante Arroyo, Eiji Onchi and **Christian I. Penaloza**: "IREP: an Interactive Robotics Education Program for Undergraduate Students", IEEE Latin American Robotics Symposium, Arequipa, Peru, October 23-25, 2013

C15 Francisco Cuellar, **Christian I. Penaloza**: "Appliance Control System Tele-operated by Brain Machine Interface", Peruvian Congress of Biomedic Engineering, Bioengineering, Biotechnology and Medical Physics (TUMI II), Lima, Peru. May 29 - 31, 2013

C16 Francisco Cuellar, **Christian I. Penaloza**, Gustavo Kato: "Robotics Education Initiative for Parent-Children Interaction", The 22nd International Symposium on Robot and Human Interactive Communication (RO-MAN), Gyeongiu, Korea. August 26 - 29, 2013.

C17 **C. Penaloza**, Yasushi Mae, Kenichi Ohara, and Tatsuo Arai: âĂIJSoftware Interface for Controlling Diverse Robotic Platforms using BMIâĂİ, IEEE/SICE International Symposium on System Integration, Fukuoka Japan. December 16-18, 2012.

C18 **C. Penaloza**, Yasushi Mae, Kenichi Ohara, and Tatsuo Arai: "Social Human Behavior Modeling for Robot Imitation Learning", Proceedings of 2012 IEEE International Conference on Mechatronics and Automation, pp.457-462, Chengdu, China, August 5-8, 2012.

C19 **C. Penaloza**, Y. Mae, K. Ohara, T. Takubo, T. Arai, "Web-Enhanced Object Category Learning from an Object Model", RSJ/SICE/JSMEãĂĂRobotics Symposia, Yamaguchi Japan. March 14-15 2012.

C20 Joachim Iden, **Christian I. Penaloza**, "Functional Safety Aspects of Pattern Detection Algorithms", The Eighth Annual IEEE International Conference on Automation Science and Engineering (CASE), Seoul, Korea. August 20-24, 2012

C21 **C. Penaloza**, Yasushi Mae, Kenichi Ohara, and Tatsuo Arai: âĂIJObject Appearance Modeling by Observing Human-Object ActionsâĂİ, Proceedings of the 30th Annual Conference of the Robotics Society of Japan. Hokkaido, Japan. Sept. 17-20 2012.

C22 Eduardo Benitez Sandoval and **Christian I. Penaloza**, "ChildrenâĂŹs Knowledge and Expectations about Robots - A Survey for Future User-Centered Design of Social Robots", ACM/IEEE International Conference on Human-Robot Interaction (HRI), Boston, Massachusetts, USA. March 5-8, 2012

C23 **C. Penaloza**, Y. Mae, K. Ohara, T. Takubo, T. Arai, "Generic Object Classifiers based on Real Image Selection from the Web", Asian Conference on Pattern Recognition (ACPR) , Beijing China. November 28-30 2011.

C24 **C. Penaloza**, Y. Mae, K. Ohara, T. Takubo, T. Arai, "Web-based Object Category Learning using Human-Robot Interaction Cues", ACM/IEEE International Conference on Human-Robot Interaction (HRI) , pp.223-224, Lausanne Switzerland. March 6-9 2011.

C25 **Christian I. Penaloza**, Y. Mae, K. Ohara, T. Takubo, T. Arai, "Multi-Appearance Object Modeling using Camera Network in Household Environment", JSME Robotics and Mechatronics Conference (ROBOMEC) , Okayama Japan. May 26-28, 2011.

C26 **Christian I. Penaloza**, Y. Mae, K. Ohara, T. Takubo, T. Arai, "Automatic Object Modeling by Observing Human-Object Interaction", The 7th International Conference on Ubiquitous Robots and Ambient Intelligence (URAI) , pp.433-436, Pusan Korea. November 24-27, 2010.

Refereed Workshops

W1 **Christian I. Penaloza**, Cesar Lucho, Francisco Cuellar: "Towards the Design of Robots inspired in Ancient Cultures as Educational Tools", The 24th International Symposium on Robot and Human Interactive Communication (Ro-MAN 2015) Cultural Robotics: Robots as Participants and Creators of Culture. Kobe, Japan. August. 31, 2015.

W2 **Christian I. Penaloza**, Yasushi Mae, Fabio DallaLibera, Alexis S. Camacho, Masaru Kojima and Tatsuo Arai: "Towards Social Imitation for Humanoid Robots", The 13th International Conference on Intelligent Autonomous Systems (IAS 2014) Evaluating Social Robots Workshop. Padova, Italy. July. 18, 2014

W3 **Christian I. Penaloza**, Sonia Chernova, Yasushi Mae and Tatsuo Arai: "Robot Reinforcement Learning using Crowdsourced Rewards", IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2013) Cloud Robotics Workshop. Tokyo, Japan. Nov. 3, 2013

W4 **Christian I. Penaloza**, Yasushi Mae, Kenichi Ohara, and Tatsuo Arai: "Robot Attention Learning in Unconstrained Environments", GCOE Cognitive Neuroscience Robotics Workshop . Nagoya, Japan. Jan 19 - 20, 2013

W5 **Christian I. Penaloza**, Yasushi Mae, Kenichi Ohara, and Tatsuo Arai: "Using Depth to Increase Robot Visual Attention Accuracy during Tutoring", IEEE International Conference on Humanoid Robots - Workshop of Developmental Robotics, Osaka, Japan. November 29- December 1st, 2012

Invited Talks

- Machine Learning en aplicaciones de interaccion humano-robot. Online webinar, Mexico. March 7th, 2018.
- Robotica, Inteligencia Artificial y Tecnologias Emergentes del Futuro. Auditorio de Mexical, Baja California, Mexico. March 15-16th 2018.
- Tecnologias Emergentes y el Futuro de las Interfaces Cerebro-Maquina - Taller de Procesamiento de Señales Neurales. Chihuahua, Mexico. Mayo 3-5 2017.
- Deep Learning from Introduction to the Current State of the Art. Osaka University, Osaka, Japan. July 2nd 2016.
- Tecnologias Emergentes y Estrategias de Innovacion. Innovation Match MX - Taller de Estrategias y Politicas de Inovacion en Mexico. Guadalajara, Jalisco, Mexico. April 8th 2016.
- Robotica, Inteligencia Artificial y TecnologÃŋas Emergentes del Futuro. Auditorio de Tlalnepantla de Baz, Estado de Mexico, Mexico. April 4th 2016.
- Introduction to BMI - Automating a Brain Computer Interface System. Singularity University, Palo Alto, CA, USA. July 2015.
- Automating a Brain Machine Interface System. University of California San Francisco (UCSF), San Francisco, CA, USA. July 2015.
- Reasons Behind the Technological Advancement of Japan: Vision and Science, Universidad de Concepcion, Concepcion, Chile. November 2014.
- Automating a Brain Machine Interface System. Pontificia Universidad Catolica del Peru (PUCP), Lima, Peru. November 2014.
- Automating a Brain Machine Interface System. San Diego State University (SDSU), San Diego, CA, USA. October 2014.
- How Will Robots Learn? Universidad Iberoamericana (UIA), Tijuana, Mexico, July 2013.

Media Coverage

Featured

- MIT Technology Review Innovators Univer 35 "Christian Penaloza - His intelligent brain control system learns from patients suffering from paralysis in order to improve the daily care they receive" November 20164. - http://www.innovatorsunder35.com/innovator/christian-pe%C3%B1aloza
- Entrepreneur Magazine "Los jovenes mexicanos que cambiaran el futuro con la tecnologia" November 20164. - https://www.entrepreneur.com/article/285717

Scientific Magazines

- Engineering & Technology Magazine: "The first brain-machine interface system capable of learning commands has been developed in Japan" United Kingdom. May 2014. - http://eandt.theiet.org/news/2014/may/brain-interface.cfm

- Phys.org: "Technology to move objects with the mind created by Mexican researcher" United Kingdom. May 2014. - http://phys.org/news/2014-05-technology-mind-mexican.html
- medGadget: "Brain-Computer Interface Learns from Users to Help Automate Tasks, Reduce Mental Fatigue" United States. May 2014. - http://www.medgadget.com/2014/05/brain-computer-interface-learns-from-users-to-help-automate-tasks-reduce-mental-fatigue.html

News Portals

- Silicon Republic "Scientists create brain-computer interface capable of learning commands", May 2015. - https://www.siliconrepublic.com/machines/2014/05/16/scientists-create-brain-computer-interface-capable-of-learning-commands
- (Spanish) La Jornada "Crea investigador mexicano tecnologÃŋa capaz de mover objetos con el pensamiento", Mexico. May 2015. - http://www.jornada.unam.mx/ultimas/2014/05/11/crea-investigadora-mexicana-tecnologia-capaz-de-mover-objetos-con-el-pensamiento-3472.html
- (Spanish) El Universal "Mexicano crea sistema para mover objetos con la mente", Mexico. May 2015. - http://www.eluniversal.com.mx/sociedad/2014/mexicano-crea-sistema-mover-objetos-mente-1010190.html
- (Italian) WebNews.it "Un casco EEG per la smart home dei disabili", Italy. May 2015. - http://www.webnews.it/2014/05/21/casco-eeg-smart-home-disabili

Service

Professional Membership

- President of Japan Chapter of the Global Network of Mexican Talent in Foreign Countries (RedGlobalMX)
- Member of the Robotics Society of Japan (RSJ)
- Member of the Institute of Electrical and Electronics Engineers (IEEE)

Conference/Symposium Chair

- Chair - IEEE/SICE International Symposium on System Integration, Fukuoka Japan. December 2012.

Journal Editor

- Associate Editor - International Journal of Advanced Robotic Systems, special issue on Distributed Robotics Systems and Society (2017)

Journal Reviewer

- Advanced Robotics (2013, 2014)
- International Journal of Mechatronics and Automation (2014)

Conference Reviewer

- ICRA (2013, 2014, 2015)
- IROS (2013, 2014)
- ROMAN (2014,2015)