



# 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	<b>Mothertongue</b>
English	<b>Native Level</b>
Japanese	<b>Business Level</b>

## 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 Wheelchair 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 Assistant for Basic Education in Mexico, (Co-Principal Investigator) 2019-2021 from CONACYT-SRE: 5,000,000mxn ( 273,000 USD)

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## 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 Wheelchair 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 **C. I. Penaloza** S. Nishio, BMI control of a third arm for multitasking. Sci. Robot. 3, eaat1228 (2018).
- 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 Intelligence (JSAI 2016) , ref.115-3, Kitakyushu, Japan. June 6-9, 2016.
- C4 Fred Achic Alarcon, Jhon Ezrad Montero Fernández, **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), Shanghai, 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, March 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. Penalzo**, 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. Penalzo**, 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. Penalzo**, Y. Mae, M. Kojima, M. Horade, K. Kamiyama and T. Arai, "Anomaly Detection using User's EEG signals", JSME Robotics and Mechatronics Conference (ROBOMECH) , Toyama Japan. May 25-29, 2014
- C12 **C. Penalzo**, 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. Penalzo**, 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. Penalzo**: "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. Penalzo**: "Appliance Control System Tele-operated by Brain Machine Interface", Peruvian Congress of Biomedical Engineering, Bioengineering, Biotechnology and Medical Physics (TUMI II), Lima, Peru. May 29 - 31, 2013
- C16 Francisco Cuellar, **Christian I. Penalzo**, Gustavo Kato: "Robotics Education Initiative for Parent-Children Interaction", The 22nd International Symposium on Robot and Human Interactive Communication (RO-MAN), Gyeongju, Korea. August 26 - 29, 2013.
- C17 **C. Penalzo**, Yasushi Mae, Kenichi Ohara, and Tatsuo Arai: "Software Interface for Controlling Diverse Robotic Platforms using BMI", IEEE/SICE International Symposium on System Integration, Fukuoka Japan. December 16-18, 2012.
- C18 **C. Penalzo**, 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. Penalzo**, Y. Mae, K. Ohara, T. Takubo, T. Arai, "Web-Enhanced Object Category Learning from an Object Model", RSJ/SICE/JSME Robotics Symposia, Yamaguchi Japan. March 14-15 2012.
- C20 Joachim Iden, **Christian I. Penalzo**, "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. Penalzo**, Yasushi Mae, Kenichi Ohara, and Tatsuo Arai: "Object Appearance Modeling by Observing Human-Object Actions", 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. Penalzo**, "Children's 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. Penalzo**, 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. Penalzo**, 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. Penalzo**, Y. Mae, K. Ohara, T. Takubo, T. Arai, "Multi-Appearance Object Modeling using Camera Network in Household Environment", JSME Robotics and Mechatronics Conference (ROBOMECH) , Okayama Japan. May 26-28, 2011.
- C26 **Christian I. Penalzo**, 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. Penalzo**, 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. Penalzo**, 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. Penalzo**, 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. Penalzo**, 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. Penalzo**, 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

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## 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 Tecnologías 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.

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## Media Coverage

### Featured

- MIT Technology Review Innovators Univer 35 "Christian Penalzoa - His intelligent brain control system learns from patients suffering from paralysis in order to improve the daily care they receive" November 2016. - <http://www.innovatorsunder35.com/innovator/christian-pe%C3%B1aloza>
- Entrepreneur Magazine "Los jovenes mexicanos que cambiaran el futuro con la tecnologia" November 2016. - <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 tecnología 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>

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## 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)

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