

# Saminda Abeyruwan

## *Curriculum vitae*

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### Research Interests

I am an enthusiastic computer scientist who pursues to solve research problems in artificial intelligence, machine learning, reinforcement learning, multi-agent systems, robotics, embedded systems, semantic web, learnable knowledge representations, and real-time reasoning. I am specifically focused on the problem of closing the gap between conceptual knowledge representation formalisms and the low-level sensorimotor data, and then generalize the knowledge for unseen circumstances. I favor team work and I also have worked in interdisciplinary research projects with domain experts from other research areas, which expanded my research horizons and analytical skills.

### Education

2010–Present **PhD Student**, *Computer Science, University of Miami, Coral Gables, Florida, USA.*

Advisor: Dr. Ubbo Visser

Thesis topic: Learnable Knowledge Representations for Autonomous Agents

Expected graduation: July, 2015

2008–2010 **MS**, *Computer Science, University of Miami, Coral Gables, Florida, USA.*

Advisor: Dr. Ubbo Visser

Thesis: PrOntoLearn: Unsupervised Lexico-Semantic Ontology Generation using Probabilistic Methods

GPA: 4.0

2000–2004 **B.Sc.**, *Electrical Engineering, University of Moratuwa, Moratuwa, Sri Lanka.*

Project: Micro Scale Village Based Dendro Power Development

GPA: 3.79 – honors with first class

### Publications

#### Refereed Journals

S. Abeyruwan, U. D. Vempati, H. Küçük-McGinty, U. Visser, A. Koleti, A. Mir, K. Sakurai, C. Chung, J. A. Bittker, P. A. Clemons, *et al.*, “Evolving BioAssay Ontology (BAO): modularization, integration and applications,” *Journal of biomedical semantics*, vol. 5, no. Suppl 1, p. S5, 2014.

V. P. Lemmon, S. Abeyruwan, U. Visser, and J. L. Bixby, “Facilitating transparency in spinal cord injury studies using data standards and ontologies,” *Neural regeneration research*, vol. 9, no. 1, p. 6, 2014.

A. Callahan, K. Sakurai, S. Abeyruwan, A. Ferguson, P. Popovich, U. Visser, J. Bixby, and V. Lemmon, “Minimum information about a spinal cord injury

experiment (miasci): Concepts and integration with the regenbase ontology,” in *Journal of Neurotrauma*, vol. 31, pp. A35–A35, 2014.

S. Abeyruwan, U. Visser, V. Lemmon, and S. Schürer, “PrOntoLearn: Unsupervised Lexico-Semantic Ontology Generation using Probabilistic Methods,” in *Uncertainty Reasoning for the Semantic Web II*, pp. 217–236, Springer Berlin Heidelberg, 2013.

U. D. Vempati, M. J. Przydzial, C. Chung, S. Abeyruwan, A. Mir, K. Sakurai, U. Visser, V. P. Lemmon, and S. C. Schürer, “Formalization, annotation and analysis of diverse drug and probe screening assay datasets using the BioAssay Ontology (BAO),” *PLoS one*, vol. 7, no. 11, p. e49198, 2012.

U. Visser, S. Abeyruwan, U. Vempati, R. P. Smith, V. P. Lemmon, and S. C. Schürer, “BioAssay Ontology (BAO): A Semantic Description of Bioassays and High-Throughput Screening Results,” *BMC Bioinformatics*, vol. 12, p. 257, 2011.

### Refereed Conference and Workshop Proceedings

S. Abeyruwan and U. Visser, “A New Real-Time Algorithm to Extend DL Assertional Formalism to Represent and Deduce Entities in Robotic Soccer,” in *RoboCup 2014: Robot Soccer World Cup XVIII* (H. A. Reinaldo, A. C. Bianchi, S. Ramamoorthy, and K. Sugiura, eds.), LNAI, (to appear), Springer Berlin / Heidelberg, 2015.

K. Poore, S. Abeyruwan, A. Seekircher, and U. Visser, “Single-and multichannel whistle recognition with nao robots,” *Robocup symposium (accepted for publication)*, 2015.

S. Abeyruwan, F. Sikder, U. Visser, and D. Sarkar, “Activity monitoring and prediction for humans and nao humanoid robots using wearable sensors,” *FLAIRS (accepted for publication)*, 2015.

S. Abeyruwan, A. Seekircher, U. Visser, R. Baral, U. Yasavur, and L. Christine, “Spoken dialog systems for health interventions using fully autonomous humanoid robots,” *FLAIRS (short paper submitted)*, 2015.

S. Abeyruwan, R. Baral, U. Yasavur, C. Lisetti, and U. Visser, “Humanoid Robots and Spoken Dialog Systems for Brief Health Interventions,” in *AAAI Fall Symposium, AI-HRI Workshop* (S. Chernova, K. Hauser, C. Jenkins, M. Matarić, A. Thomaz, and M. Veloso, eds.), AAAI Fall Symposium Series, pp. 2–4, AAAI press, 2014.

A. Seekircher, J. Stoecker, S. Abeyruwan, and U. Visser, “Motion capture and contemporary optimization algorithms for robust and stable motions on simulated biped robots,” in *RoboCup 2012: Robot Soccer World Cup XVII* (X. Chen, P. Stone, L. E. Sucar, and T. Van der Zant, eds.), Mexico City: Springer Berlin / Heidelberg, to appear, 2013.

Saminda Abeyruwan and Andreas Seekircher and Ubbo Visser, “Dynamic Role Assignment using General Value Functions,” in *AAMAS 13 Workshop on Adaptive Learning Agents* (Sam Devlin and Daniel Hennes and Enda Howley, ed.), (Saint Paul, MN), 2013.

S. Abeyruwan, A. Seekircher, and U. Visser, “Dynamic Role Assignment using General Value Functions,” in *IEEE Humanoid Robots, HRS workshop* (S. Behnke, T. Röfer, and U. Visser, eds.), (Osaka, Japan), IEEE, 2012.

U. Vempati, U. Visser, S. Abeyruwan, K. Sakurai, M. Przydzial, C. Chung, R. P. Smith, A. Koleti, C. Mader, V. P. Lemmon, and S. C. Schürer, “Bioassay Ontology to Describe High-Throughput Screening Assays and their Results,” in *ICBO*, 2011.

A. Seekircher, S. Abeyruwan, and U. Visser, “Accurate Ball Tracking with Extended Kalman Filters as a Prerequisite for a High-level Behavior with Reinforcement Learning,” in *The 6<sup>th</sup> Workshop on Humanoid Soccer Robots at Humanoid Conference, Bled (Slovenia)* (S. Behnke, T. Roefer, and P. Stone, eds.), 2011.

S. Abeyruwan, U. Visser, V. P. Lemmon, and S. C. Schürer, “PrOntoLearn: Un-supervised Lexico-Semantic Ontology Generation using Probabilistic Methods,” in *URSW*, pp. 25–36, 2010.

#### Non-Refereed Scientific Contributions

S. Abeyruwan, A. Seekircher, and U. Visser, “Off-Policy General Value Functions to Represent Dynamic Role Assignments in RoboCup 3D Soccer Simulation,” *CoRR*, 2014.

S. Abeyruwan, C. Chung, N. Datar, F. Gayanilo, V. Lemmon, C. Mader, M. Ogihara, K. Sakurai, R. Smith, U. Vempati, *et al.*, “BAOsearch: a semantic web application for biological screening and drug discovery research,” 2010.

S. Abeyruwan, P. Indrasiri, D. Perera, and U. Suduge, “Micro Scale Village Based Dendro Power Development,” 2004.

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## Academic Research

2010–Present **Research Assistant**, *University of Miami, Department of Computer Science, Coral Gables, USA.*

### 1. BioAssay Ontology Development

- During this project, we have used Description Logic and Bayesian networks to capture the semantics in high throughput screening assays for minimal information formalisms and assay annotation.
- I have developed a state-of-the art ontology modularization framework to handle large scale ontologies without compromising the interpretation of the domain of discourse.
- I have developed a framework to reason large scale ontologies using standard OWL 2 reasoners and the Hadoop Map-Reduce framework. This framework has been used in the preliminary stages of the knowledge-based reporting project.

### 2. RegenBase Ontology Development

- The development of OWL 2 ontologies that allow domain experts to link data and results from studies on nervous system injury and disease to data and knowledge from other domains with an emphasis on molecular targets and the small molecules that perturb their function to speed the development of novel therapeutics.
- I have developed various Protégé plugins (e.g. paper annotation plugin, OBO2OWL) based on the requirements from domain experts to expedite knowledge acquisition, and assay annotation phases. These tools are used in related ontology projects in different capacities.

### 3. RoboCup Soccer

- I have used the RoboCup Standard Platform (NAO humanoid robots) and the 3D Soccer Simulation League as test environments to conduct research on learnable knowledge representations and real-time reasoning to build autonomous agents.
- I have extended the  $SROIQV^D$  description logic to represent dynamic knowledge of the world without compromising satisfiability guarantees. In addition to this, I have used general value function in reinforcement learning as a method to represent predictive knowledge in role assignments in soccer formations.

### 4. Embedded Systems

- I have developed unification methodologies to detect abnormal events, e.g., a fall event, for humans and biped humanoid robots while performing normal activities such as jogging, running and so forth.
- In this study, I have developed: 1) methods to learn and predict different activities for humans and robots; and 2) software tools to realize these functions on embedded devices. The main contributions include: 1) detection of falls for both humans and robots within a unified framework; and 2) a novel software development environment for embedded systems.

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## Teaching

Fall 2011 **Instructor**, *University of Miami, Department of Computer Science, Coral Gables, USA.*

- I have prepared and taught the graduate course "Semantic Web" with Dr. Ubbo Visser. I have prepared lecture materials, assignments, and course schedule from scratch.

2008–2010 **Teaching Assistant**, *University of Miami, Department of Computer Science, Coral Gables, USA.*

- I have taught and graded computer science courses during the fall and spring semesters for the following classes: 1) Computer Programming I (CSC120); 2) Computer Programming II (CSC220); 3) Computer Organization and Architecture (CSC314); 4) C Programming and UNIX (CSC322); 5) Principles of Computer Operating Systems (CSC421); and 6) Introduction to Artificial Intelligence (CSC545). I was responsible for teaching labs, helping with assignments, and giving occasional seminars. I received awards in recognition of my teaching skills and performance from the department.

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## Employment

Summer 2014 **Software Developer**, *University of Miami, Center for Computational Science, Miami, USA.*

- The development of internal tools to support research activities in different projects, specially, BioAssay Ontology and RegenBase projects.
- Developed a Hadoop based framework to support knowledge base reporting and parallel reasoning for OWL ontologies.

Summer 2013 **Software Developer**, *University of Miami, Center for Computational Science, Miami, USA.*

Summer 2012 **Software Developer**, *University of Miami, Center for Computational Science, Miami, USA.*

Summer 2011 **Software Developer**, *University of Miami, Center for Computational Science, Miami, USA.*

2005–2008 **Technical Lead**, *WSO2 Inc, Colombo, Sri Lanka.*

- The design and development of middleware applications using the principles of service-oriented architecture and Apache Web services projects. These applications were implemented in C++ and Java languages to integrate services with Web 2.0 front ends.
- The research and development of applications that utilized OSGi technologies in server-side, and embedded systems.
- Managed a software team to integrate the Web Services Application Server with Apache Web services.
- The development of enterprise service bus with Apache Synapse project.

Spring 2003 **Software Development Intern**, *Ceylon Electricity Board, Colombo, Sri Lanka.*

- Assisted in the development of a project based on C++ that monitors the national power grids.

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## Community

- 2005–Present **Committer and Program Committee Member**, *Apache Software Foundation*.
- I am an active committer for Apache Axis2, Synapse, and Axiom projects. I am a founding member of Apache Synapse project.

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## Invited Talks

- Dec 2014 **WSO2, Inc, Colombo, Sri Lanka**, “Learnable Knowledge Representations for Autonomous Agents”.

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## Service

### Reviewer.

- International Journal of Advanced Robotic Systems
- International Semantic Web Conference
- Journal of Intelligent & Robotic Systems
- Journal on Multimodal User Interfaces
- Robotics – Open Access Journal
- RoboCup Symposium Proceedings
- Uncertainty Reasoning for the Semantic Web II

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## Software

- 2013–Present **RLLib**, *C++ Template Library to Predict, Control, Learn Behaviors, and Represent Learnable Knowledge using On/Off Policy Reinforcement Learning*.
- This is a lightweight C++ template library that implements incremental, standard, and gradient temporal-difference learning algorithms in reinforcement learning. It is an optimized library for robotic applications and embedded devices that operates under fast duty cycles (e.g.,  $\leq 30$  ms). RLLib has been tested and evaluated on RoboCup 3D soccer simulation agents, physical NAO V4 humanoid robots, and Tiva C series launchpad microcontrollers to predict, control, learn behaviors, and represent learnable knowledge.
- 2014–Present  **$\mu$ Energia**, *C++ Framework to Develop Embedded Software*.
- This is a software development platform for MSP-EXP430G2 LaunchPad, Tiva C Series EK-TM4C123GXL LaunchPad, and Tiva C Series TM4C129 Connected LaunchPad. The framework is lightweight, flexible, and consumes minimum memory and computational resources to build applications and rational agents on microcontrollers that sense and actuate using add-on boards.

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## Languages

- Sinhalese **Native**
- English **Fluent, written and orally**

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## Computer Skills

Professional C, C++, Java, JavaScript, and Matlab for both Linux and Windows.  
Platform CUDA, Apache Hadoop, WebGL, Arduino, and Energia.  
IDE Eclipse CDT and IntelliJ IDEA.

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## Interests

Badminton I am an active Badminton player since 1995. I was the president of University of Miami Badminton Club from 2009–2012. My duties were to manage all activities related to the club, and participating in tournaments.

Cricket I professionally played Cricket for my high school, De Mazenod College, Kandana, Sri Lanka, from 1993–1996. Currently, I participate in recreational Cricket tournaments in South Florida.

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## Continuing Education

In my free time, I have tried to keep my knowledge sharp in a number of areas using open source courses from:

coursera.org Machine Learning (Stanford University), Neural Networks for Machine Learning (University of Toronto), Heterogeneous Parallel Programming (University of Illinois at Urbana-Champaign), Control of Mobile Robots (Georgia Institute of Technology), and Game Theory (Stanford University & The University of British Columbia).

edx.org EE40LX Electronic Interfaces (BerkeleyX).