http://web.mit.edu/manjola/www/ **MANUSHAQE MUCO** manjola@mit.edu
https://github.com/manjola 617-678-5676

EDUCATION

Massachusetts Institute of Technology Cambridge, MA
Master of Engineering (M.Eng.) in **Electrical Engineering and Computer Science** September 2017
- Thesis: *"An Exploration Of Strategies For Discrete Learning"*
- Advisor: *Gerald Jay Sussman*
- Award: *Submitted for MIT EECS Master's Thesis Award, Spring 2018*

Massachusetts Institute of Technology Cambridge, MA
Bachelor of Science (S.B.) in **Computer Science and Engineering** June 2015
- Thesis: *"Modelling Traits Using Common Actions and Its Applications to a Story Understanding System"*
- Advisor: *Patrick H. Winston*
- Award: *MIT EECS Undergraduate Research and Innovation Scholar*

RESEARCH EXPERIENCE

MIT CSAIL (Computer Science and Artificial Intelligence Laboratory) September 2017 - current
Researcher, *under Gerald Jay Sussman*
- Posing the question of compositionality as an engineering question: How do we take two or more machines to build a compound machine, such that the compound machine has the combined abilities of its constituent parts, plus the abilities that arise from the cooperation between its parts?
- Investigating possible plumbings (mechanisms and architectures) that would allow different parts to talk to each other in complex ways.

MIT CSAIL (Computer Science and Artificial Intelligence Laboratory) September 2016 - September 2017
Master Thesis Work, *under Gerald Jay Sussman* goo.gl/aA1Dfn
- Proposed a multi-level crossbar with bidirectional discrete wires as a substrate that allows for biologically plausible computation and communication, and candidate algorithms for a local learning protocol between two connected agents.
- The combination of the two agents and the learning protocol is equivalent to a compressing discrete autoencoder on unsupervised small data.
- It can also be generalized as a Programmable Logic Array-analogous structure with uncertainty, i.e. incorporating "don't know" values to the existing true and false values, for which we can ask what possible functions can be learned locally.

MIT Media Lab January 2016 - August 2016
Researcher, *Mind Group*
- Proposed a network architecture that uses neural nets as infrastructure (to get feature detection and recognition), and combines general function approximators (combining the outputs of the neural nets) with state machines in an attempt to emulate something analogous to the neural activity in the cerebral cortex.
- Proposed the candidacy of the architecture units as a model for approximation of a cortical function.

Mind Group (non-profit)**,** at **MIT Media Lab** November 2015 - current
Co-Creator and **Researcher** mind.media.mit.edu
- Working on understanding the nature of the mind through integrative theories of cognition, by creating models and concepts that bridge between methodologies, and can support theory-driven research.
- Studying the design space of cognitive architectures, as constrained by artificial intelligence, neuroscience, and cognitive sciences.

MIT CSAIL (Computer Science and Artificial Intelligence Laboratory) January 2015 - May 2015
Researcher, *Decentralized Information Group (DIG)* goo.gl/k8GCzx
- Worked on how semantic web-based rule systems can deal with incomplete information when inferring and providing

explanations in the context of law and policy-making, by using propagator-like models of deductive reasoning with tracked dependencies to model weak knowledge and known-unknowns data types.
• Worked on integrating this with the semantic web-based rule language AIR(Amord In RDF).

MIT CSAIL (Computer Science and Artificial Intelligence Laboratory) June 2014 - December 2014
Undergraduate Researcher, *Genesis Group*
• Worked on modelling how humans interpret situations/stories and evaluate interpretations, based on their unique combination of characteristics (age, background, culture, etc).
• Applied the work to the story-understanding system Genesis.
• Worked on a partial self-model for the system, i.e. backtracking to show "reasoning" for coming up with a certain interpretation.

Massachusetts Institute of Technology November 2014 - December 2014
Independent Research, *STORYSCAPE: Spatial Reconstruction of Stories* `github.com/manjola/STORYSCAPE`
• To bridge story understanding with perception, I created a system that uses a set of story elements to construct spatial relations between actors, events, and places, and produce a graphical representation of the story.
• The system also discovers spatial relations between story elements, and makes inferences about the places where the events in the story take place.

MIT CSAIL (Computer Science and Artificial Intelligence Laboratory) September 2013 - May 2014
SuperUROP (EECS Advanced Undergraduate Research Program), *Genesis Group*
Bachelor Thesis Work `github.com/manjola/modelling_traits_common_actions`
• Modelled traits (personality traits, dispositions, cases in between) using common actions to address: common-sense, mental models, and learning the meaning of a word (concept) by example.
• Showed a method for extracting the mappings of traits and common actions from literature.
• Provided an application to the story-understanding system Genesis, in the form of a Trait Layer.

Heidelberg University (Ruprecht-Karls-Universität Heidelberg) June 2013 - August 2013
Undergraduate Researcher, *Optimization in Robotics and Biomechanics Group* `github.com/manjola/TSPviz`
• Built a tool for visualizing algorithms in a fun and dynamic manner on a tangible user interface reactable-machine and personal computers.
• Applications included: 1) extension of Travelling Salesman Problem to simplified real world scenarios, such as traffic jams or road constructions and 2) pedagogical purposes, such as teaching algorithms.

MIT CSAIL (Computer Science and Artificial Intelligence Laboratory) June 2012 - August 2012
Undergraduate Researcher, *Evolutionary Design and Optimization Group*
• Worked on enabling cloud-scale evolutionary machine learning, by designing, implementing, and running different instantiations of parallelization frameworks matched to distributed models of genetic programming.

MIT CSAIL (Computer Science and Artificial Intelligence Laboratory) January 2012 - April 2012
Undergraduate Researcher, *under Muriel Medard*
• Worked on identifying the algebraic properties that allow for solutions in non-multicast networks.

PUBLICATIONS

Technical Reports

Muco, Manushaqe. Chen,Changping. Hamlin, Ariel. Lim, Jeffrey Lim. *ROCK, PAPER, SCISSORS...Cheat — Verified Decentralized Game Play.* Course project, 6.857: Computer and Network Security, MIT. Spring 2015
https://courses.csail.mit.edu/6.857/2015/files/chen-hamlin-lim-muco.pdf

Muco, Manushaqe. Zaman, Cagri. *STORYSCAPE: Spatial Reconstruction of Stories.* Course project, 9.S915: Aspects of a Computational Theory of Intelligence, MIT. Fall 2014
http://web.mit.edu/manjola/www/storyscape-spatial-reconstruction.pdf

Book Reviews
Muco, Manushaqe. *Book Review: Why Only Us? - Language and Evolution.* Course project, 9.523/6.861: Science of Intelligence/Computational Intelligence, MIT. Fall 2016
http://web.mit.edu/manjola/www/Why-Only-Us-Review.pdf

Muco, Manushaqe. *Book Review: The Society of Mind.* Course project, MAS.S66: Future Destinations in Artificial Intelligence, MIT Media Lab. Fall 2015
http://web.mit.edu/manjola/www/Society-of-Mind-review.pdf

Working Papers
Muco, Manushaqe. "*Local Learning Algorithms for Training Discrete Autoencoders on Unsupervised Small Data"*
Muco, Manushaqe. "*Bridging the Gap Between Connection and Symbolic Systems: A Proposed Mechanism"*

POSTER PRESENTATIONS

SuperUROP Research Poster Presentations. MIT EECS, Grier Room. Cambridge, MA. December 5, 2013.
Masterworks: Master Thesis Research Presentation. MIT EECS. Cambridge, MA. April 18, 2018.

TEACHING EXPERIENCE

Co-Creator & Co-Instructor
• MIT MAS.S63 Integrative Theories of Mind and Cognition, *graduate level* Spring 2016
Co-created and Co-instructed an official graduate-level AI class at MIT. futureai.media.mit.edu
Teaching Assistant
• Harvard CSCI E-11 Introduction to the Challenges and Opportunities of Big Data, the Internet of Things, and Cyber-security, *undergraduate & graduate* Fall 2017
• MIT 6.945/6.905 Large-scale Symbolic Systems**,** *graduate level* Spring 2017
• MIT 9.66/9.660/6.804 Computational Cognitive Science, *graduate level* Fall 2016
• MIT 6.S083 Computation and Linguistic Theory, *graduate level* Fall 2015
• MIT 6.042 Mathematics for Computer Science, *undergraduate level* Fall 2011 - Fall 2014
Lab Assistant
• MIT 6.S191 Introduction to Deep Learning, *undergraduate & graduate level* January 2017
• MIT 6.02 Digital Communication Systems, *undergraduate level* Fall 2014

SKILLS

Programming: Scheme, LISP, Python, Java, JavaScript, MATLAB, C/C++, Unix, HTML, CSS, LaTeX
Protocols & APIs: XML, RDF, JSON, SOAP
Databases: MySQL
Tools: Emacs, SVN, Vim, Git
Technical Strengths: Symbolic Artificial Intelligence, Dependency Tracking, Model-based Reasoning, Commonsense Reasoning, Mathematics, Deep Learning/Neural Nets, Machine Learning.
Languages: Albanian (Native), English (Native/Multilingual), Italian (Native/Multilingual), French (Fluent), Spanish (Fluent), Portuguese (Fluent), Japanese (2 years equivalent)

LEADERSHIP

• **International Mathematics Olympiad (IMO) Albanian Team**, *Coach* June 2015 - June 2017
• **airesources.org**, *Editor* Fall 2015 - current
• **MIT USAGE** *(Undergraduate Student Advisory Group for EECS)* Fall 2012 - Spring 2014
  • Started SuperUROP, a year-long advanced undergraduate research program.
  • New EECS curriculum.
  • New EECS Student Lounge.

ACTIVITIES

Minsky Institute for Artificial Intelligence; MIT SIPB (Student Information Processing Board)**; MIT Robotics Team**

HONORS AND AWARDS

- **AI Grant Finalist,** https://aigrant.org, **(Fall 2017)**
- **Vatra Scholarship Award**, accorded by the Vatra Educational Foundation, to excellent students of Albanian lineage pursuing higher education in USA **(2016)**
- **MIT EECS Undergraduate Research and Innovation Scholar (2013, 2014)**, given for work/research done on the Bachelor Thesis.
- **First Place** & **Full Scores for the Matura Exams 2009 of the Republic of Albania.**
- **"Golden Medal" for the Matura 2009** & **"Golden Prism Award" for the Matura 2009**, given for excellent results during High School and Matura Exams, accorded by the Ministry of Education and Science of Albania **(25.12.2009)**
- **"Protagonist of The Year 2008" Award**, given for excellent results in math olympiads and science competitions, accorded by the Municipality of Vlora, Albania **(24.12.2008)**
- **First Place, IMO (International Mathematical Olympiad) qualifications for the Albanian Team (2007 - 2009)**
- **First Place, BMO (Balkan Mathematical Olympiad) qualifications for the Albanian Team (2007 - 2009)**
- **Honorable Mention, 24th Balkan Mathematical Olympiad**, Rhodos, Greece **(2007)**
- **First Place, Regional Mathematical Olympiad (Albania, Montenegro, Kosovo, Serbia, Macedonia, Greece)**, organized by the Mathematics and Informatics Magazine "Plus" **(2003 - 2009)**
- **First Place, 5th Balkan Mathematics Olympiad "Fest-Mathematica"**, Durres, Albania **(2004)**
- **First Place, Albanian Mathematical Olympiad, National Level (2001 - 2009)**
- **First Place, Albanian Mathematics and Science Competition, National Level (2002 - 2005)**