Luc **Caspar**

MACHINE LEARNING RESEARCHER · RESEARCH ENGINEER

14 Bis rue des trois pics, 67190, Mutzig, France

☐ (+33) (0)7.67.26.27.78 | ✉ casparluc@gmail.com | ⌂ www.casparluc.me | ⌷ casparluc | ☰ domochevski | ⓘ luc-caspar

Summary

Recently, graduated from the University of Sheffield with a PhD degree in affective science and machine learning. With seven years experience writing Python software for controlling robots in both real and virtual environments, among other applications.

Owned a small business centered around Web technologies for four years. Accustomed to working within a Linux environment. Finally, a keen interest for all things related to artificial intelligence, more specifically to the mechanisms underlying memory and learning in the animal's brain, as well as reinforcement learning. I am looking forward to working on projects that will further our understanding of the human mind and contributing toward the creation of a general artificial intelligence.

Education

University of Sheffield ⚯   *Sheffield, The United Kingdom*

PHD DEGREE   *Sep. 2014 — Feb. 2021*

- Worked on my project entitled: "*The Role of Emotions in Autonomous Social Agents*", that sits at the crossroad of neuroscience, robotics, artificial intelligence and affective science.
- The goal of the project was to show that emotions inform the brain as to the nature of a given situation and guide the decision-making process, to increase the survival potential of virtual agents.
- In particular, I showed that by using a computational model of the circuits found at the base of the forebrain a group of virtual agents was able to outperform other emotional agents in terms of survival capabilities.

Shinjuku Nihongo Gakko (SNG) ⚯   *Tokyo, Japan*

LANGUAGE INSTITUTION   *Sep. 2012 — Sep. 2013*

- Enrolled in a language institution in an effort to learn more about the Japanese language and culture.
- Completed the beginner and intermediate levels.

Osaka Prefecture Univerity (OPU) ⚯   *Osaka, Japan*

MASTER DEGREE   *Sep. 2011 — Sep. 2012*

- Double degree in computer science and intelligent system achieved through a partnership between the EISTI and OPU.

EISTI (graduate school in computer science and information processing) ⚯   *Pau, France*

ENGINEER DIPLOMA   *Sep. 2009 — Sep. 2012*

- Private engineering school specialzed in data processing, machine learning, and mathematics.

Lycée Couffignal ⚯   *Strasbourg, France*

PREPARATORY CLASSES FOR ENGINEERING SCHOOLS (CPGE)   *Sep. 2007 — Sep. 2009*

- Part of the post-secondary education system.
- These two intensive years provide the knowledge and training required to take the entrance exams for the different engineering schools.

Lycée Louis Marchal ⚯   *Molsheim, France*

BACCALAURÉAT S, SPECIALIZATION ENGINEERING SCIENCES   *Sep. 2004 — Sep. 2007*

- Part of the standard french curriculum.
- Subjects such as mathematics, physics, mechanics, electronics, and programming are covered in depth.

Work experience

Altran ⚯   *Strasbourg, France*

AI CONSULTANT & ENGINEER   *Nov. 2018 — May 2019*

Created a workshop for the Museum called "*Le Vaisseau*" ⚯. The aim of the workshop was to introduce children between the age of five and twelve to the concepts of AI. For the group activity I was in charge of, I had to build a deep learning system capable of categorizing audio clips, where each clip consisted in a person mimicking the sound of an object or animal. For example, a child would imitate the sound of a car or a lion, and the system would output an image corresponding to a car or a lion, respectively. The system was trained on Google's Audioset ⚯. The system achieved an 80% accuracy on a test set made of recordings of children mimicking different sound of different objects.

Python, Git, Tensorflow, Keras, Websocket, SocketIO, Linux

The University of Sheffield ⚯   *Sheffield, United Kingdom*

SOFTWARE ENGINEER   *Oct. 2015 — Jan. 2016*

Developed material for the laboratory sessions of the "*Machines and Intelligence*" (COM1005) module, whose purpose was to introduce the Nao robot and its Pyton API to students.

<div align="center">Python, Nao robot, Naoqi, Git, Latex, Gimp 2.x, Linux</div>

Omnilog SA ⚲
Neully-sur-Seine, France

Junior Software Engineer
Apr. 2014 — Aug. 2014

Part of the maintenance team for the French newspaper: "*Le Monde*", whose mission is to fix any problems within the publication software or the company's website.

<div align="center">Php5, SQL, Javascript, Ajax, JQuery, Html5, Css3, Linux, Git</div>

Artaud, Courthéoux & associés (ACA) ⚲
Paris, France

Junior Software Engineer
Jul. 2013 — Feb. 2014

The main mission was the development of a Web Application to manage the customers of an insurance company, along with the different contracts they subscribed to.

<div align="center">SQL, Java, Java EE, Java Beans, Javascript, Ajax, JQuery, REST Api, Html5, Css3</div>

Creatix-web
Paris, France

Co-founder
Aug. 2010 — Feb. 2014

A company, created with Nicolas Ilhe, whose focuse was on bulding website and web-designs. It also provided web hosting services. The purpose of this project was to gain experience in programming, management, and client relationship.

<div align="center">Php5, SQL, Javascript, Html5, Css3, JQuery, Ajax, Backbone.js, REST Api, Gimp 2.x, Apache 2, Linux</div>

Extracurricular Activity

Deep Learning Specialization ⚲
Coursera

Deeplearning.ai
Jan. 2021

- Neural Networks and Deep Learning
- Convolutional Neural Networks
- Structuring Machine Learning projects
- Improving Deep Neural Networks: Hyperparameters tuning, regularization and optimization
- Sequence Models

Reinforcement Learning Specialization ⚲
Coursera

University of Alberta & Alberta Machine Intelligence Institute
Feb. 2021

- Fundamentals of Reinforcement Learning
- Sample-based Learning Methods
- Prediction and Control with Function Approximation
- Implementation of a complete Reinforcement Learning System

Mathematics for Machine Learning Specialization ⚲
Coursera

Imperial College London
Ongoing

- Linear Algebra
- Multivariate Calculus
- Principal Component Analysis

Skills

Programming	Python 2/3, Java, Java EE, C/C++, Bash
Frameworks	Numpy / SciPy, DEAP, Thespian, Tensorflow, Keras, OpenAi Gym, HDF5 / h5py, SocketIO
Web Development	Html 4/5, Php 7, Css 2/3, Javascript, Ajax, JQuery, REST Api, Backbone.js, Django, Websockets Requests
Integrated Development Environment	PyCharm, Vim / NeoVim
Office	Latex, LibreOffice
Robotics	Robot Operating System (ROS), Webots, E-Puck robot, Nao robot, Naoqi, Sphero, Gazebo
Design	Inkscape, Gimp 2.x, Dia
System Administration	Apache 2.x, Arch Linux, Ubuntu Desktop / Server
Machine Learning	Reinforcement Learning, Genetic Algorithms, Artificial/Deep Neural Networks, LEABRA / Emergent
Databases	MySql, MariaDB
Miscellaneous	Mendeley, Amazon Web Services

Languages

French	Native
English	TOEIC: 900, TOEFL: 105
Japanese	Beginner
German	Beginner

Presentation

AISB 2017
Bath, United Kingdom

TALK
21 Apr. 2017

- A presentation detailing the ProtoEmo architecture, which was developed during my PhD project, and whose design is based on the survival circuits made of the Thalamus, Amygdala, and Hypothalamus (three areas found at the base of the animal's brain).
- The talk also described the simulation results gathered using ProtoEmo as a control mechanism for groups of virtual agents having to survive in a dynamic environment.

EuCog 2016
Vienna, Austria

POSTER
08 Dec. 2016

- Presented a poster introducing the basic concepts upon which the ProtoEmo architecture had been developed.
- The poster also contained some preliminary simulation results showing the potential of the ProtoEmo architecture as a control/decision-making system.

SICE 2012
Osaka, Japan

TALK
2012

- An extended presentation of the results gathered during my master project at Osaka Prefecture University.

SCI 2012
Osaka, Japan

TALK
2012

- A presentation describing the model of emotions developed for my master project.
- The talk also included some preliminary results showing the potential of using emotions in teams of co-evolving robots.

Writing

[Re] An Anatomically Constrained Neural Network Model of Fear Conditioning
Rescience C 🔗

AUTHOR
ongoing

- Describes the reproduction of an experiment first reported by Armony et al. (1995) in an article entitled: "*An Anatomically Constrained Neural Network of Fear Conditioning*".
- The original paper describes a computational model of the '*Two pathways to the Amygdala*', which uses non-linear neural units to approximate the behavior of a population of real neurons, and learns via a modified Hebbian update rule.
- Replicated in this paper is a classical conditioning experiment showing that the model exhibits conditioned responses analogous to those observed in animals, and that units within the model exhibit changes in activity during conditioning similar to those observed in single-cell recordings.

ProtoEmo: Investigating the role of the '*Survival Circuits*' in social agents
IEEE Transactions on Affective Computing

AUTHOR
ongoing

- Emotions have been described as a mechanism that evolved to increase the survival potential of animals. Relying on this definition, LeDoux (2012) suggested that in the animal's brain there exist '*Survival Circuits*' in charge of maintaining the body's homeostasis. He further theorized that those same circuits act as the trigger to an emotional episode.
- Using LeDoux's survival circuit theory, the **ProtoEmo** architecture modeled after the connections between the Thalamus, the Amygdala, and the Hypothalamus, was built to investigate if the survival circuits, identified as being essential to an animal's survival, could also be applied to influence the actions of virtual agents.
- To explore the validity of this hypothesis, the **ProtoEmo** architecture was used as a control mechanism for groups of virtual agents in a resource foraging task. In addition, from foraging for energy each agent could fight, run away, and procreate. For this simulation, the agents' ultimate goal was to at least survive, and at best increase the size of the population.
- Compared to other emotional agents, the virtual agents controlled by the **ProtoEmo** architecture managed to evolve a strategy which allowed them to increase the group's size ten fold. Thus, it was concluded that not only are the survival circuits also applicable to virtual agents, the amygdala was also identified as the trigger for more complex full-fledged emotions.

PrimEmo: Investigating the role of emotions in the decision-making process

AUTHOR

- Based on the results gathered via the **ProtoEmo** architecture, I hypothesized that the addition of a system capable of encoding the salience of survival relevant situational features would enhance the survival capabilities of virtual agents in complex and dynamic environments. Furthermore, the mechanisms responsible for representing a feature's salience would also trigger an emotional episode.
- To investigate the validity of those hypotheses, the **ProtoEmo** architecture has been combined with a model of the decision-making process developed by Frank et al. (2001). The resulting system was named **PrimEmo** and has been tested in a more complex version of the resource foraging task.
- Viking Doom is an online roguelike game in which multiple heroes have to collect as much gold as possible in a given amount of time. Each hero is characterized by a level of strength, its remaining level of health, and the amount of gold gathered so far. To grow stronger a hero can fight against different types of enemies, at the risk of dying if its life is depleted. Finally, on the contrary to the resource foraging task used for the **ProtoEmo** architecture, heroes did not belong to the same group, and could, therefore, also fight against each other.
- A hero controlled by the **PrimEmo** architecture was compared to two heroes which used DQN and A2C, respectively, to learn an optimal strategy. In the end, although, the **PrimEmo** controller performed similarly to the A2C, the strategies adopted by each learning mechanism were quite different. Indeed, whereas the A2C had a rather '*aggressive*' policy, which focused on gathering gold at the risk of killing its hero, **PrimEmo** more highly valued the life of its agent, giving up gold if it meant keeping its hero alive.

The Role of Emotions in Autonomous Social Agents ⌗

AUTHOR

- The thesis describing the different steps, architectures, simulations, and experimental results obtained during my PhD project.

PrimEmo: A Neural Implementation of Survival Circuits Supporting Primitive Emotions ⌗

AUTHOR

- An article presented at the AISB convention in 2017, detailing the PrimEmo architecture developed during my PhD degree.

Introduction of Emotions in Coevolving Multi-agent System

AUTHOR

- A second article presented at the SICE conference during my master degree at Osaka Prefecture University.
- Details the model of human emotions developed for my master project.

Emotion and Coevolution of Learning Robots Teams

AUTHOR

- An article presented at the SCI conference during my master degree at Osaka Prefecture University.
- Introduces the model of human emotions built during my master project.