Denamganaï Kevin

Postdoc Researcher in Artificial Intelligence

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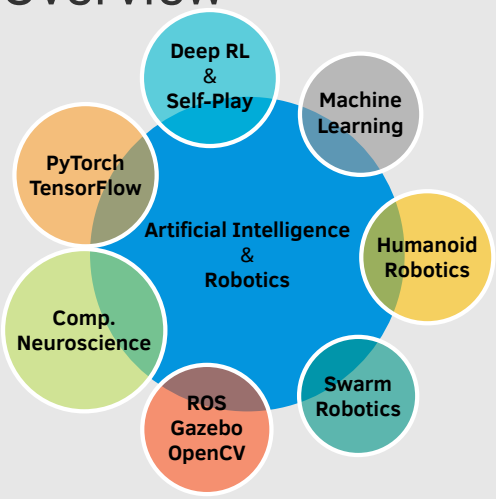
Near32

Overview



Programming

C • C++ • Python • LaTeX

C# • Java • Mathematica

Language

French - Native
English - Bilingual (**TOEFL 105**)
Japanese - Professional Proficiency
Spanish - Conversant
German - Conversant

Projects

ReferentialGym:
Emergent Communication and Language Grounding via Referential Games, using PyTorch.
Archi:
Modular and reconfigurable building blocks for Deep Learning applications.
Regym:
A Single- and Multi-Agent / Self-Play Deep Reinforcement Learning framework.
RelationalReasoning:
Deep Relational Reasoning algorithms, using PyTorch.
PyTorch_VAE:
Replication of many Disentangling β-VAE variants following [Higgins et al., 2018].
GazeboRL:
Deep Reinforcement Learning framework using ROS & Gazebo.
GazeboDomainRandom:
Domain Randomization tools following [Tobin et al. 2018], for object recognition.
Core:
Computer Algebra System in C/C++.
HaRo:
3D printable MG995-based Raspberry Pi-powered humanoid robot.
EKF-DATMO:
Extended Kalman Filter-based solution to the DATMO problem.
SIMULATOR:
3D Rigid-body Physics & Rendering Engine in C/C++ for video games.

Education & Research

2024 - 2026
Postdoc Research Associate in Machine Learning and Physical Simulation
University of Edinburgh, Scotland, UK

- **Project**: Physics Reasoning and Language Models
- Investigating how to **enable language models to reason reliably about physical systems**, despite their lack of embodiment and poor numerical understanding and processing abilities.
- Co-developed **CueTip (*SIGGRAPH 2025*), an interactive, explainable, physics-aware pool coaching assistant**. CueTip instruments a physics simulator to emit natural language event traces — ball–ball collisions, ball–cushion rebounds, and ball–pocket events — enabling a closed-loop coupling between simulator and Language Model. Shot-selection and their explanations are grounded in a curated set of domain-expert heuristics derived from the billiards literature, yielding physically-aware, reliable natural language coaching whilst maintaining or improving agent win rate.
- Developed **DLMI — Language Model Inversion through End-to-End Differentiation**. Proposed a paradigm shift in the conceptualisation of Language Models: redefining them as functions operating over sequences of probability distributions over tokens (SDoTs), rather than sequences of discrete tokens. This shift, implemented via swapping the embedding module for a soft embedding module and the common categorical sampling module for a Gumbel-Softmax-based next-token sampling module, **enables theoretically-ground and practically-efficient end-to-end differentiability for any frozen, white-box LM**. The resulting DLMI algorithm efficiently optimises prompts via stochastic gradient descent to yield target output sequences, addressing the Language Model Inversion (LMI) problem at scales an order of magnitude beyond the prior state of the art.
- Co-developed **xInv**, a general methodology for producing human-interpretable explanations of iterative optimisation processes for inverse problems. The central contribution is the instrumentation of differentiable simulators to emit natural language signals during the forward and backward passes. A post-hoc scheme then exploits a language model to synthesise step-level and global descriptions from the resulting trace, **enabling interactive query-based explanation of otherwise-opaque optimisation processes**.
- Investigating the hypothesis that language models' physical reasoning abilities may be enhanced by framing physics-reasoning tasks through domain-specific languages (DSLs). Exploring unsupervised architectures — drawing on principles of Emergent Communication and referential game frameworks — to discover physics-specific programming languages that serve as structured, human-interpretable and language-model-efficient intermediaries between natural language and physical simulation.

2018 - Present (Thesis submitted 2024; revisions ongoing)
PhD Researcher, Intelligent Games and Game Intelligence (IGGI)
University of York, England, UK.

- **Thesis**: Emergent Languages as a Tool for Artificial Thoughts
- **Awarded 4 years funding from the EPSRC via IGGI.**
- Proposed a **nomenclature for Referential Games**, in its latest resurgence in deep learning, and implemented a PyTorch-based framework designed around it, entitled ReferentialGym.
- Investigating (artificial) **language emergence** and the (emerging) **systematicity** of the neural players of Referential Games.
- Investigating **zero-shot human-computer cooperation**, by proposing the Symbolic Behaviour Benchmark.
- Proposed **ETHER (Emergent Textual Hindsight Experience Replay)** to extend the Hindsight Experience Replay and investigate alignment between Emergent and Natural Languages.
- Proposed **EReLELA to improve Exploration in Reinforcement Learning via Emergent Language Abstractions** and investigated comparison of Emergent and Natural languages in terms of the abstraction they perform.

2013 - 2017
Engineering Degree, Computer Science and Systems
Ecole Nationale Supérieure de l'Electronique et de ses Applications, France

- **Final-Year Project**: Development of a 3**D rigid-body physics and rendering engine, entitled SIMULATOR**, for a video game project in C/C++.
- Designing and building of a 3**D-printable humanoid robot, entitled HaRo**, using MG995 servomotors and Raspberry Pi.
- Development of a **Computer Algebra System, entitled Core** for automatic differentiation of Neural Networks architectures in C/C++.

2015 - 2017
Research MSc., Artificial Intelligence and Robotics
Université de Cergy-Pontoise, France

- **Thesis**: Visual Contexts for a Spatial Recognition System in Wide Environments
- Reviewed biologically-inspired robotic vision and focused on a neuronal architecture aiming at solving the online spatial recognition problem.
- Investigating a coarse-to-fine filtering scheme making use of hebbian-weighted adaptation and parallels visual information pathways integrated in a cognitive map.

2016 - 2017
MEng., Electrical Engineering and Information Science (GPA: 3.7/4)
Osaka Prefecture University, Japan

- **Thesis**: Adaptability Features in a Nonlinear System-based Swarm of Robots
- Proposed two obstacle avoidance behaviours designed as nonlinear system-based controllers in order to shore up the bridge between nonlinear systems and swarm robotics, following our laboratory's previous works.
- Investigating the synthesis potential of nonlinear system-based controllers with a deep learning-based controller in a deep reinforcement learning framework.

Certifications

2025 **Reinforcement Fine-Tuning LLMs with GRPO**

- Deeplearning.AI

2024 **LLMOps**

- Deeplearning.AI

2023 **Quality & Safety for LLM Applications**

- Deeplearning.AI

2023 **Building & Evaluating Advanced RAG**

- Deeplearning.AI

2023 **LangChain for LLM Application Development**

- Deeplearning.AI

2023 **Machine Learning in Weather and Climate**

- European Centre for Medium-Range Weather Forecasts

2021 **Associate Fellowship of the HEA (AFHEA)**
⇒ **Portfolio**
- York Learning And Teaching Award Course

2017 **Deep Learning Foundation Nanodegree**

- Udacity

2014 **Autonomous Navigation for Flying Robots (AUTONAVx)**

- Edx

2015 **Autonomous Mobile Robots (AMRx)**

- Edx

2015 **Underactuated Robotics (6.832x)**

- Edx

2014 **Computational Neuroscience**

- Coursera

Experience

⋈ 2023 **6-months PhD Research Internship** **Sony Interactive Entertainment Europe**

Research and development into using **Emergent Language Abstractions** for better **Exploration in Reinforcement Learning**.

⋈ 2021-2022 **6-months PhD Research Internship** **Digital Creativity Labs**

Collaboration with Revolution Software to research and develop **Style Transfer** approaches for video game assets creation, using 3D aware representation learning approaches with Generative Adversarial Networks (GANs) and Diffusion Models.

⋈ 2020-2023 **Graduate Teaching Assistant** **University of York, Computer Science Dept.**

- Mathematical Foundations of Computer Science (COM00013C)
- Formal Languages and Automata (COM00014C)
- Multi-Agent Interactions & Games (COM00009H)
- Intelligent Systems 1: Search & Representation (COM00020I)
- Computability and Complexity (COM00023I)
- Introduction to Software and Systems Engineering (COM00019I)

⋈ 2016-Present **Artificial Intelligence & Robotics Freelancer** **Upwork**

- Development of a **Tool-Augmented Chatbot User Interface** to perform various task automation, powered by Open-Source Large Language Models (LLMs) and **Genetically-Evolved Prompts**, using **LangChain**
- Development of a **Tool-Augmented Chatbot User Interface**, using Retrieval-Augmented Generation (RAG) system on bespoke documents and responses to various API queries, powered by Open-Source Large Language Models (LLMs), **LangChain** and Google APIs
- Development of a **Q&A Chatbot User Interface on bespoke documents**, using Retrieval-Augmented Generation (RAG) system, powered by Open-Source Large Language Models (LLMs) and **LangChain**
- On-screen 2D gaze pose tracking system for hand-held devices with **PyTorch**.
- Domain randomization tools using **MakeHuman** and **Blender**.
- Semi-supervised GAN for car make and model classification using **TensorFlow**.
- 3D bot-human interface, using **Blender** and **Panda3D**'s Python API.
- Policy Neural Network for a Backgammon AI, using **TensorFlow**.
- Development of Navigation & Planning algorithms for a Roomba-like robot, using **ROS** & **Gazebo**.

Publications

- K. Denamganai, and K. Subr, **Language Model Inversion through End-to-End Differentiation** , preprint arXiv:2602.11044, 2026.
- S. Memery, K. Denamganai, A. Kapron-King, and K. Subr, **xInv: Explainable Optimization of Inverse Problems** , preprint arXiv:2506.11056, 2025.
- S. Memery, K. Denamganai, J. Zhang, Z. Tu, Y. Guo, and K. Subr, **CueTip: An Interactive and Explainable Physics-aware Pool Assistant** , SIGGRAPH2025, 2025.
- K. Denamganai, T. Bradley, P. Vito Amadori, S. Missaoui, G. Moss, and J. Walker, **EReLELA: Exploration in Reinforcement Learning via Emergent Language Abstractions** , rejected from NeurIPS2024 ; OpenReview preprint , 2024.
- K. Denamganaï, D. Hernandez, O. Vardal, S. Missaoui, and J. Walker, **ETHER: Aligning Emergent Communication for Hindsight Experience Replay**, preprint arXiv:2307.15494, 2023.
- K. Denamganaï, S. Missaoui, and J. Walker, **Visual Referential Games Further the Emergence of Disentangled Representations**, preprint arXiv:2304.14511, 2023.
- K. Denamganaï, S. Missaoui, and J. Walker. **Meta-Referential Games to Learn Compositional Learning Behaviours**, preprint arXiv:2207.08012, 2022.

- K. Denamganaï and J. Walker, **On (Emergent) Systematic Generalisation and Compositionality in Visual Referential Games with Straight-Through Gumbel-Softmax Estimator**, in *4th NeurIPS Workshop on Emergent Communication*, 2020.
- K.Denamganaï and J. Walker, **ReferentialGym: A Nomenclature and Framework for Language Emergence & Grounding in (Visual) Referential Games**, in *4th NeurIPS Workshop on Emergent Communication*, 2020.
- D. Hernandez, K. Denamganaï, S. Devlin, S. Samothrakis and J. A. Walker, **A Comparison of Self-Play Algorithms Under a Generalized Framework**, in *IEEE Transactions on Games (ToG)*, doi: 10.1109/TG.2021. 3058898.
- D. Hernandez, K. Denamganaï, Y. Gao, P. York, S. Devlin, S. Samothrakis and J. Walker, **A Generalized Framework for Self-Play Training**, in *Proceedings of the 2019 IEEE Conference on Games (CoG)*, pp. 1-8, 2019.
- K. Denamganai, T. Nakamura, N. Hara and K. Konishi, **"Obstacle avoidance control law for two-wheeled mobile robots controlled by oscillators"**, in *Proceedings of the 61st Annual Conference of the Institute of Systems, Control and Information Engineers (ISCIE)*, 221-4, 2017.
- K. Denamganai, T. Nakamura, N. Hara and K. Konishi, **"Coupled Kuramoto oscillator-based control laws for both formation and obstacle avoidance control of two-wheeled mobile robots"**, *IEICE Technical Report*, NLP2017-44, pp. 87-91, 2017.

Academic Services

⋈ 2026
- **ICML : International Conference on Machine Learning**
  ⇒ Role: Reviewer - 6 Papers
- **AAAI Conference on Artificial Intelligence - AI Alignment Track**
  ⇒ Role: Reviewer - 2 Papers
- **ICLR International Conference on Learning Representations**
  ⇒ Role: Reviewer - 4 Papers

⋈ 2025
- **NeurIPS Conference on Neural Information Processing Systems**
  ⇒ Role: Reviewer - 3 Papers
- **AAAI Conference on Artificial Intelligence**
  ⇒ Role: Reviewer - 6 Papers
- **ICLR International Conference on Learning Representations**
  ⇒ Role: Reviewer - 4 Papers

⋈ 2024
- **AAAI Conference on Artificial Intelligence**
  ⇒ Role: Reviewer - 2 Papers
- **ICLR International Conference on Learning Representations**
  ⇒ Role: Reviewer - 1 Paper
- **ICML : International Conference on Machine Learning**
  ⇒ Role: Reviewer - 5 Papers
- **NeurIPS Conference on Neural Information Processing Systems**
  ⇒ Role: Reviewer - 4 Papers

⋈ 2023
- **AAAI Conference on Artificial Intelligence**
  ⇒ Role: Reviewer - 3 Papers
- **ICML : International Conference on Machine Learning**
  ⇒ Role: Reviewer - 5 Papers
- **NeurIPS Conference on Neural Information Processing Systems**
  ⇒ Role: Reviewer - 2 Papers

⋈ 2022

- **Emergent Communication Workshop** @ ICLR 2022
  ⇒ Role: Co-Organizer & Reviewer - 6 Papers
  ⇒ Co-Recipient of the Best Reviewer Award
- **ICML : International Conference on Machine Learning**
  ⇒ Role: Reviewer - 5 Papers
- **NeurIPS Conference on Neural Information Processing Systems**
  ⇒ Role: Reviewer - 4 Papers

⋈ 2021

- **NeurIPS Conference on Neural Information Processing Systems**
  ⇒ Role: Workshop Proposal Reviewer - 5 Applications