

Róbert Csordás

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EDUCATION

IDSIA <http://idsia.ch>, Lugano, Switzerland

PhD student

2018-present

Supervised by Prof. Jürgen Schmidhuber. Working on systematic generalization.

Budapest University of Technology and Economics, Budapest, Hungary

Electrical Engineering. MSc (grad. 2015) and BSc (grad. 2012). Grade: excellent.

WORK

EXPERIENCE

DeepMind - <https://www.deepmind.com>

2022 june - 2022 october

Research Scientist Intern

London, United Kingdom

I worked on graph neural networks, improving generalization on algorithmic problems and external memory for Transformers.

AIMotive (formerly AdasWorks) - <https://aimotive.com>

2015-2018

AI Research Scientist

Budapest, Hungary

Worked on deep neural networks for self driving cars.

- Monocular depth prediction using neural networks.
- Neural stereo matching - predicting robust depth map with neural network.
- Recurrent network research - Convolutional LSTMs for stabilizing detections, free space detection, etc.
- Object detection, semantic segmentation

Hungarian Academy of Sciences - Institute for Computer Science and Control - <https://www.sztaki.hu>

2015

Software Engineer

Budapest, Hungary

Worked on classical computer vision projects. For example:

- Detecting objects thrown over the fence; detecting human leaving a car.
- Autonomous forklift control system.

Innomed Medical Inc. - <http://innomed.hu>

2007 - 2015

Embedded Software/Hardware Engineer

Budapest, Hungary

- Designed the software architecture of Linux based patient monitor (C++, QT).
- Maintained the software of the InnoCare-S patient monitor (C++).
- Wrote low level hardware drivers for InnoCare-T12.

PUBLICATIONS

Kazuki Irie*, Róbert Csordás*, Jürgen Schmidhuber: **Topological Neural Discrete Representation Learning à la Kohonen** - We show that VQ used in VQ-VAEs is a special case of SOMs, which are more robust and converge faster.

arXiv preprint

<https://arxiv.org/abs/2302.07950>

Róbert Csordás, Kazuki Irie, Jürgen Schmidhuber: **CTL++: Evaluating Generalization on Never-Seen Compositional Patterns of Known Functions, and Compatibility of Neural Representations** - We extend the CTL dataset to test systematicity and show how NNs develop incompatible representations and fail to generalize.

EMNLP 2022

<https://arxiv.org/abs/2210.06350>

Borja Ibarz, Vitaly Kurin, George Papamakarios, Kyriacos Nikiforou, Mehdi Bennani, Róbert Csordás, Andrew Dudzik, Matko Bošnjak, Alex Vitvitskyi, Yulia Rubanova, Andreea Deac, Beatrice Bevilacqua, Yaroslav Ganin, Charles Blundell, Petar Veličković: **A Generalist Neural Algorithmic Learner** - We show that graph neural networks are capable of learning many algorithms together and they can generalize to larger problem instances.

LoG 2022

<https://arxiv.org/abs/2209.11142>

Kazuki Irie*, Róbert Csordás*, Jürgen Schmidhuber: **The Dual Form of Neural Networks Revisited: Connecting Test Time Predictions to Training Patterns via Spotlights of Attention** - We investigate dual form representations of NNs to get insights into how their behaviour depends on the training samples.

ICML 2022

<https://arxiv.org/abs/2202.05798>

Kazuki Irie, Imanol Schlag, Róbert Csordás, Jürgen Schmidhuber: **A Modern Self-Referential Weight Matrix That Learns to Modify Itself**

ICML 2022

<https://arxiv.org/abs/2202.05780>

Róbert Csordás, Kazuki Irie, Jürgen Schmidhuber: **The Neural Data Router: Adaptive Control Flow in Transformers Improves Systematic Generalization** - We propose to improve data routing in Transformers by gating and geometric attention, achieving systematic generalization on algorithmic tasks.

ICLR 2022

<https://arxiv.org/abs/2110.07732>

Róbert Csordás, Kazuki Irie, Jürgen Schmidhuber: **The Devil is in the Detail: Simple Tricks Improve Systematic Generalization of Transformers** - We significantly improve the systematic generalization of Transformers on a variety of systematic generalization datasets using simple tricks.

EMNLP 2021

<https://arxiv.org/abs/2108.12284>

Kazuki Irie, Imanol Schlag, Róbert Csordás, Jürgen Schmidhuber: **Going Beyond Linear Transformers with Recurrent Fast Weight Programmers** - We explore the recurrent Fast Weight Programmers (FWPs), which exhibit advantageous properties of both Transformers and RNNs.

NeurIPS 2021

<https://arxiv.org/abs/2106.06295>

Róbert Csordás, Sjoerd van Steenkiste, Jürgen Schmidhuber: **Are Neural Nets Modular? Inspecting Functional Modularity Through Differentiable Weight Masks** - We develop a method for analyzing emerging functional modularity in neural networks based on differentiable weight masks and use it to point out important issues in current-day neural networks.

ICLR 2021

<https://openreview.net/forum?id=7uVcpu-gMD>

Róbert Csordás, Jürgen Schmidhuber: **Improving Differentiable Neural Computers Through Memory Masking, De-allocation, and Link Distribution Sharpness Control** - Addresses 3 different issues with the original DNC architecture. Also proposes a new, better content-based lookup mechanism.

ICLR 2019

<https://openreview.net/forum?id=HyGEM3C9KQ>

Róbert Csordás, László Havasi, and Tamás Szirányi: **Detecting objects thrown over fence in outdoor scenes** - A new technique for detecting objects thrown over a critical area of interest in a video sequence made by a monocular camera.

VISAPP 2015

<http://goo.gl/ZDkk4g>

WORKSHOP PAPERS	Kazuki Irie, Imanol Schlag, <u>Róbert Csordás</u> , Jürgen Schmidhuber: Improving Baselines in the Wild <i>NeurIPS 2021 DistShift</i> https://openreview.net/forum?id=9vx0rkNTs1x
HIGH SCHOOL PUBLICATIONS	CallTheTux - Development of CallTheTux, a universal GSM stack for Linux. <i>Petnica Papers, 2007</i> https://goo.gl/QTcy5U RealVM - Development of a new type of virtual machine which would allow parallel execution and fast switching between different operating systems. <i>Petnica Papers, 2006</i> https://goo.gl/8TNhf5 PrologAPI - Enabling the usage of Prolog constructs from C++. <i>Petnica Papers, 2005</i> https://goo.gl/KpV3sF
PATENTS	<u>Róbert Csordás</u> , Ágnes Kis-Benedek, Balázs Szalkai: Method and Apparatus for Generating a Displacement Map of an Input Dataset Pair - A neural network based method for fast and robust stereo matching for depth map generation. <i>US10380753</i> https://patent.uspto.gov/fdd/53/807/103/0.pdf
TECHNICAL STRENGTHS	Python, PyTorch, TensorFlow, C, C++, CUDA, OpenCV, Algorithms, Linux, JavaScript, Bash, Matlab, Assembly
OTHER SKILLS	Machine learning frameworks: PyTorch, TensorFlow, Torch Parallel programming: CUDA, numba Electronics: KiCAD, Eagle, PIC, PIC32, AVR, AVR32, ARM, X MOS, Xilinx Databases: MySQL, MongoDB, Sphinx search JavaScript technologies: NodeJS, jQuery Mobile development: Android, iOS (Swift) Operating systems: Linux, OS X, Windows Markup languages: L ^A T _E X, XML, Markdown
HOBBY PROJECTS	MobileECG II - https://github.com/robertcsordas/MobileECG-II 2014 - 2016 Open source Holter ECG. Designed the schematic diagram and the firmware. engineerjs.com - http://engineerjs.com 2013 - 2015 Extendable online computing environment for engineers, with physical quantity, complex numbers and linear algebra support.
LANGUAGES	Hungarian (native); English, Serbian (fluent); Italian (intermediate); German (beginner)