II. Országos HUN-REN Cloud Találkozó

csütörtök 2025. nov. 13. 9:00 → 17:10 Europe/Budapest

HUN-REN Központ (Budapest)

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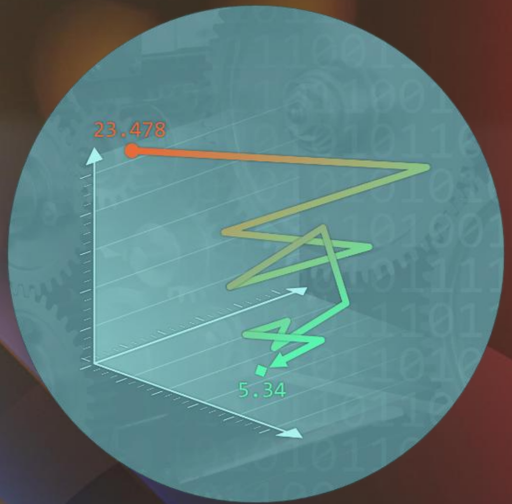
HUN-REN Cloud



Gépi tanulás algoritmusainak átfogó tesztelése

HUN-REN Institute for Computer Science and Control (HUN-REN SZTAKI)
Research Laboratory on Engineering and Management Intelligence, **Intelligent Processes Research Group**

Dr. Zsolt János Viharos

HUN-REN
Hungarian Research Network

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Mottónk

Amíg megbeszélünk / alszunk / utazunk / konferencián vagyunk /HUN-REN központban előadunk / programozunk / kísérletezünk / cikket írunk / …

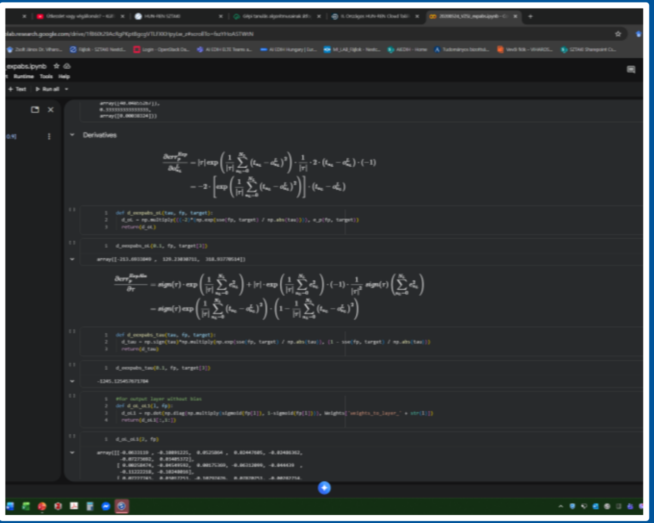
…VALAMI MINDIG FUSSON!!!

…kutatási témánként…

HUN-REN Cloud

Versenytársak

Google colab



Fejleszteni, de nem futtatni, **megszakad, megáll**

Saját “COMPUTE” szerverünk

Futtatni, megbízható, **nem fejleszteni (memóriahibák…)**

HUN-REN Cloud

Futtatni, megbízható, nem fejleszteni (WIN update)

General information

	EMI Compute	ELKH Cloud
#Machine	1	4
OS	Debian GNU/Linux 10	Ubuntu 20.04.3 LTS
CPU	Intel(R) Core(TM) i9-7960X	Intel Xeon Processor
#CPU	32 (limited to 12)	16 (4CPU/Machine)
Physical GPU	4x NVIDIA GeForce RTX 2080 Ti	1x Tesla V100
GPU	4x NVIDIA GeForce RTX 2080 Ti	4x GRID V100DX-8C (vGPU)
GPU RAM	12GB	8GB

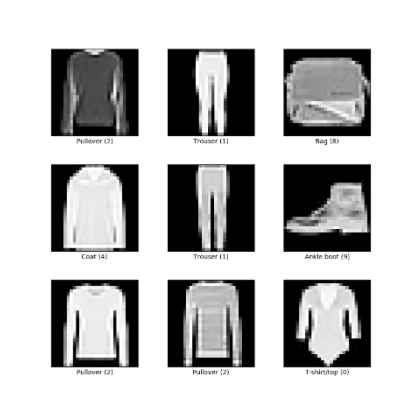
Conclusion

- **Compute ~2.5x faster than ELKH Cloud**
  - 50% improvements of the GPU capacity

- *Good distribution of our assignments:*
  - ***Classifications, optimization*** *should be on* ***Compute*** *(larger computational load)*
    - Computing accuracy (30x)
    - Feature number optimization (30x)
    - Kernel optimization (30x)
  - ***Input search*** *(smaller computational load) can be run on* ***ELKH Cloud***
    - The less features the faster training
    - Working with sensor datasets!

Optimal allocation of our *concrete* scientific tests

- **Compute**
  - **#1 Input search: Cifar10**
  - **#2 Input search: Coil-20**
  - **#3 Classifications, parameter optimization (30 avgs)**
  - **#4 Input search: Cifar10 SOTA architecture (UNET)**
- **ELKH Cloud**
  - **#1 Input search: MIT-BIH**
  - **#2 Input search: Skoda mini**
  - **#3 Input search: Opportunity**
  - **#4 Others**



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Projekt neve	Intézmény	Projekt vezetője	Telephely	Projektzárás	Beküldés ideje	Módosítva ↑	Állapot	
Gépi tanulás algoritmusainak átfogó tesztelése	HUN-REN Számítástechnikai és Automatizálási Kutatóintézet	Dr. Viharos Zsolt János	SZTAKI	2026-03-31	2021. Jan. 19. 15:57	2025-03-13 18:00	Current	Edit

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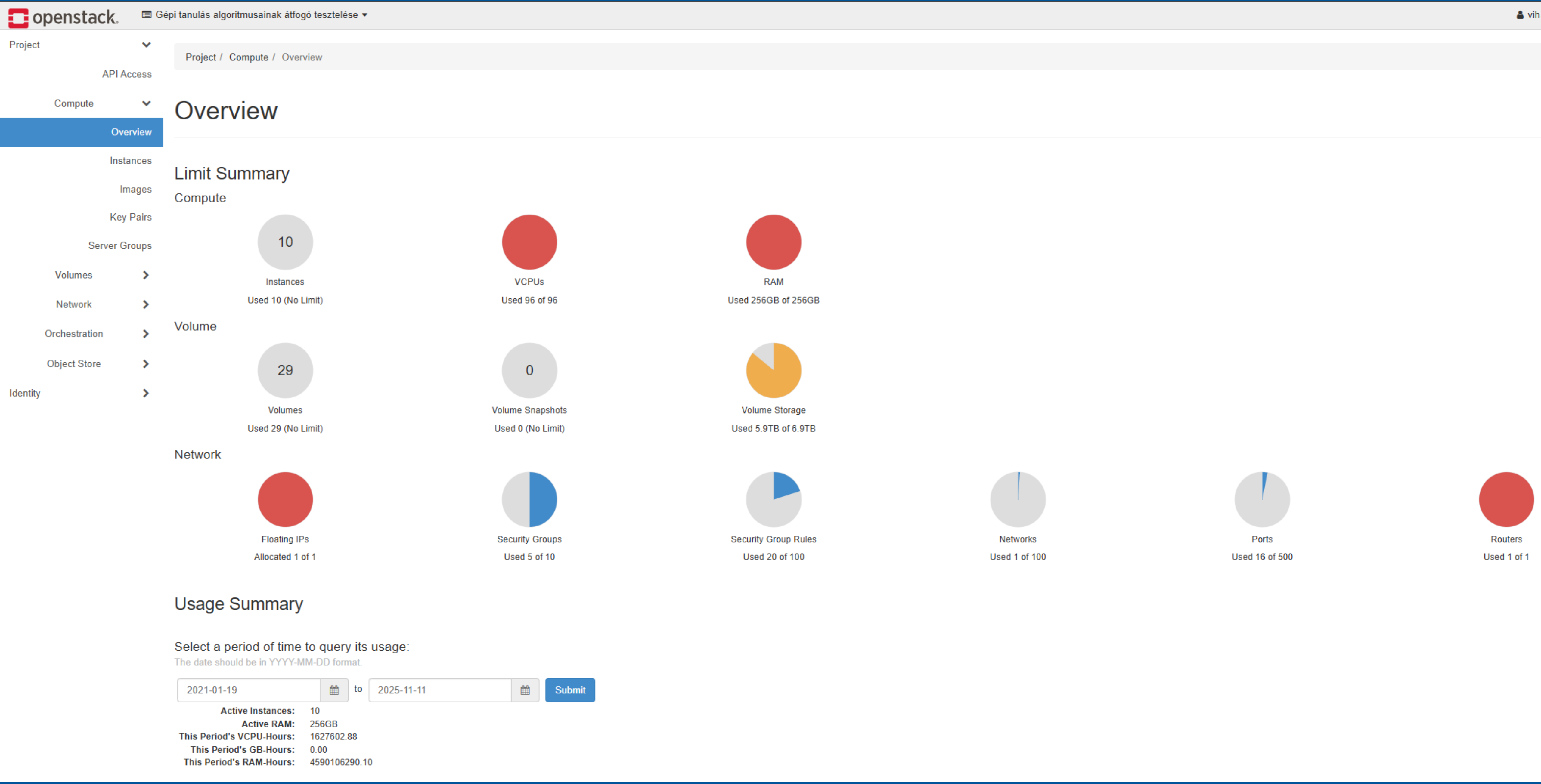
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vih
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Key Pairs
Server Groups
Volumes
Network
Orchestration
Object Store
Identity
Project / Compute / Overview
Overview
Limit Summary
Compute
10
Instances
Used 10 (No Limit)
VCPUs
Used 96 of 96
RAM
Used 256GB of 256GB
Volume
29
Volumes
Used 29 (No Limit)
0
Volume Snapshots
Used 0 (No Limit)
Volume Storage
Used 5.9TB of 6.9TB
Network
Floating IPs
Allocated 1 of 1
Security Groups
Used 5 of 10
Security Group Rules
Used 20 of 100
Networks
Used 1 of 100
Ports
Used 16 of 500
Routers
Used 1 of 1
Usage Summary
Select a period of time to query its usage:
The date should be in YYYY-MM-DD format.
2021-01-19
to
2025-11-11
Submit
Active Instances: 10
Active RAM: 256GB
This Period's VCPU-Hours: 1627602.88
This Period's GB-Hours: 0.00
This Period's RAM-Hours: 4590106290.10

openstack. Gépi tanulás algoritmusainak átfogó tesztelése ▾ viharos@sztaki.hu ▾

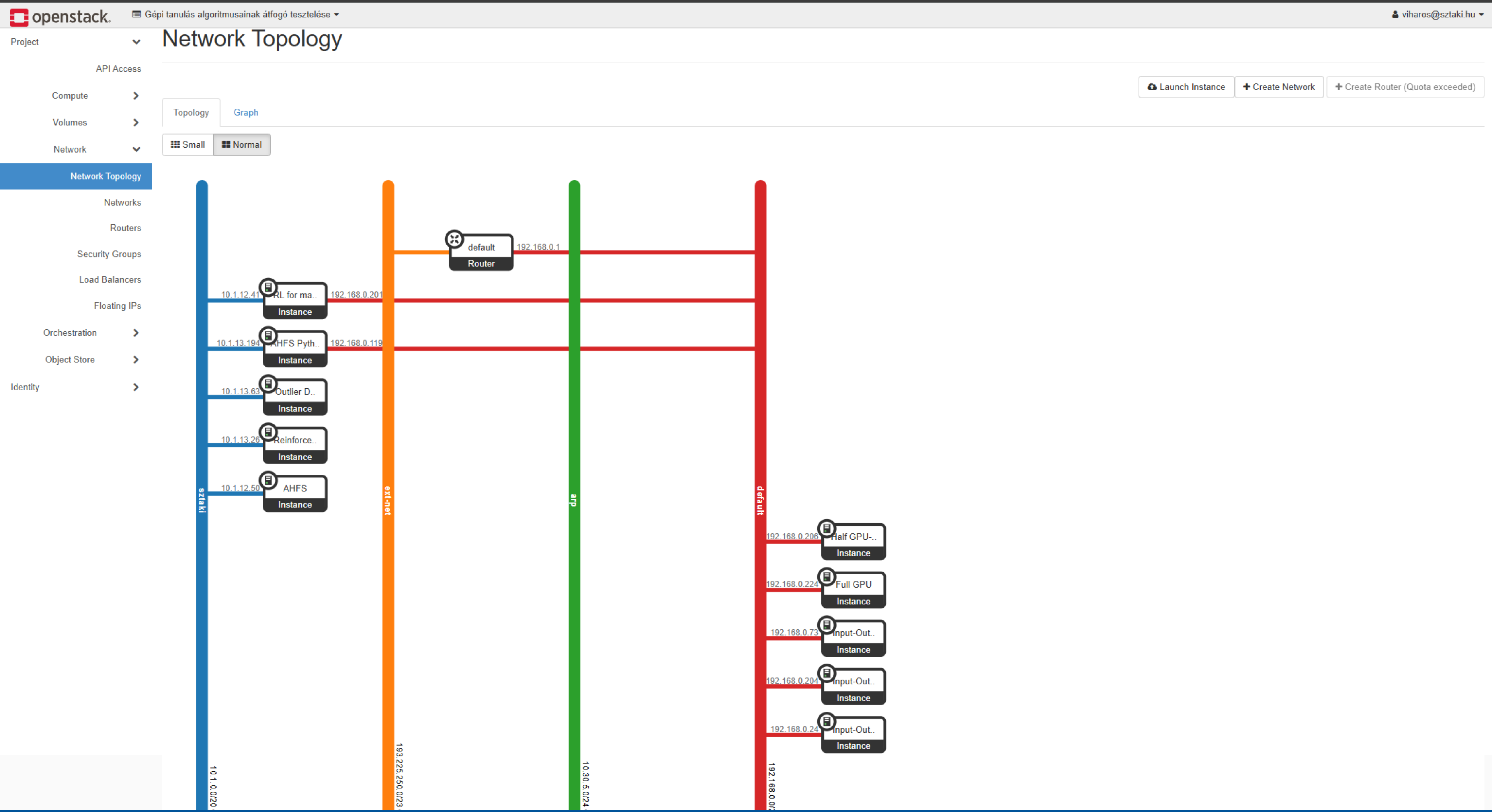
- Project
  - API Access
  - Compute
  - Volumes
    - **Volumes**
    - Snapshots
    - Groups
    - Group Snapshots
  - Network
  - Orchestration
  - Object Store
- Identity

Filter | + Create Volume | ⇄ Accept Transfer | Delete Volumes

Displaying 20 items | Next »

Name	Description	Size	Status	Group	Type	Attached To	Availability Zone	Bootable	Encrypted	Actions
22798050-dabe-4af6-bfd4-9de6ed8a6056	-	85GiB	In-use	-	SSD	/dev/sda on RL for manufacturing	nova	Yes	No	Edit Volume
80362abb-486c-4efb-b503-69ad45e25051	-	120GiB	In-use	-	SSD	/dev/sda on AHFS Python	nova	Yes	No	Edit Volume
4a4969be-6204-421f-ac1b-1727e7ce525b	-	130GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
ba5593eb-dbd0-4082-b77c-721551f21914	-	200GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
98e23ffb-b5ef-46a4-a25c-cf14406ecf60	-	20GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
4438e506-b287-4cca-ba00-cb93ec300db4	-	20GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
Outlier Detection - v2	-	160GiB	In-use	-	SSD	/dev/vda on Outlier Detection	nova	Yes	No	Edit Volume
Outlier_HDD	Outlier_HDD	100GiB	In-use	-	HDD	/dev/vdb on Outlier Detection	nova	No	No	Edit Volume
AHFS	Storage volume (D drive) for AHFS VM.	1000GiB	In-use	-	HDD	/dev/vdb on AHFS	nova	No	No	Edit Volume
Reinforcement Learning	Storage volume (D drive) for Reinforcem...	1000GiB	In-use	-	HDD	/dev/vdb on Reinforcement Learning	nova	No	No	Edit Volume
Information Theory and Statistics	Storage volume (D drive) for Informatio...	1000GiB	In-use	-	HDD	/dev/sdc on RL for manufacturing	nova	No	No	Edit Volume
Reinforcement Learning	-	160GiB	In-use	-	SSD	/dev/vda on Reinforcement Learning	nova	Yes	No	Edit Volume
Information Theory and Statistics	-	160GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
Deep Learning	-	160GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
AHFS	-	160GiB	In-use	-	SSD	/dev/vda on AHFS	nova	Yes	No	Edit Volume
Information Theory and Statistics_LINUX_THE_REAL_THING	-	160GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
Outlier Detection	-	160GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
Full Volume	-	512GiB	In-use	-	HDD	/dev/sdc on Full GPU	nova	No	No	Edit Volume
fc099bfb-ee8f-480e-9e76-cd6953d04152	-	32GiB	Available	-	SSD	-	nova	Yes	No	Edit Volume
4afcaa9a-71d6-4dd8-8ab1-47c7c6bf079d	-	32GiB	In-use	-	SSD	/dev/sda on Half GPU-1	nova	Yes	No	Edit Volume

Displaying 20 items | Next »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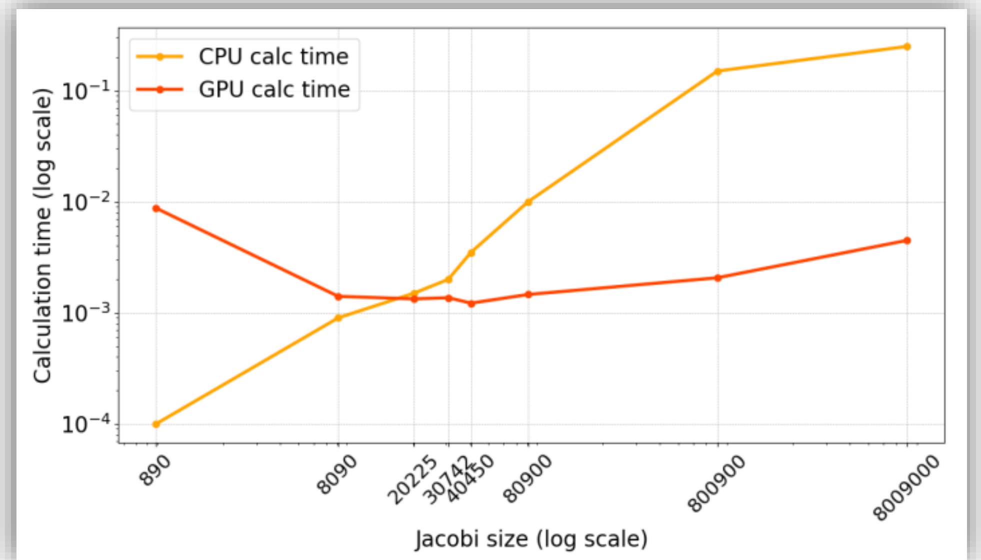
Routers
Security Groups
Load Balancers
Floating IPs
Orchestration
Object Store
Identity
Network Topology
Launch Instance
Create Network
Create Router (Quota exceeded)
Topology
Graph
Small
Normal
default
Router
192.168.0.1
10.1.12.41
RL for ma..
Instance
192.168.0.201
10.1.13.194
AHFS Pyth..
Instance
192.168.0.119
10.1.13.63
Outlier D..
Instance
10.1.13.26
Reinforce..
Instance
10.1.12.50
AHFS
Instance
sztaki
ext-net
arp
default
192.168.0.206
Half GPU-..
Instance
192.168.0.224
Full GPU
Instance
192.168.0.73
Input-Out..
Instance
192.168.0.204
Input-Out..
Instance
192.168.0.24
Input-Out..
Instance
10.1.0.0/20
193.225.250.0/23
10.30.5.0/24

Statisztika (?!)

- ***Total VCPU Usage (Hours)*:1 627 604.67 óra**
  - Kb. 5 év x 365 nap x 24 óra/nap = 43 800 óra
  - 1627604.67 / 43 800 = **370.5%**

  …/ 96 VCPU
  - **3.8% kihasználtság**
  - ***…GPU szinten azért (talán) lényegesen magasabb…***
- ***Total Memory Usage (Hours)*: 4 590 111 193.60 óra**
  - Kb. 5 év x 365 nap x 24 óra/nap = 43 800 óra
  - 4 590 111 193.60 / 43 800 = **104 797 %**

  …/ 256 GB
  - **409% kihasználtság (??)**



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Címlap | Projektek → Gépi tanulás algoritmusainak átfogó tesztelése

Gépi tanulás algoritmusainak átfogó tesztelése

Megtekintés Szerkesztés Tagok

Cél: gépi tanulás és mesterséges intelligencia alap-, és alkalmazott kutatási algoritmusainak átfogó tesztelése.

- Információelméleti és statisztikai integrált tanuló algoritmus mértékek
- Adaptív, hibrid jellemzőválogatás (AHFS)
- Megerősítéses tanulás ipari kiterjesztése, adaptálása
- Megerősítéses tanulás kiterjesztése önvezető, driftelő járműre
- Outlier detektálás hiányos adatokkal
- Input-output modellstruktúra keresés

13	96	256 GB	2 TB	4.9 TB	64 GB
VM	vCPU	RAM	SSD	HDD	GPU RAM

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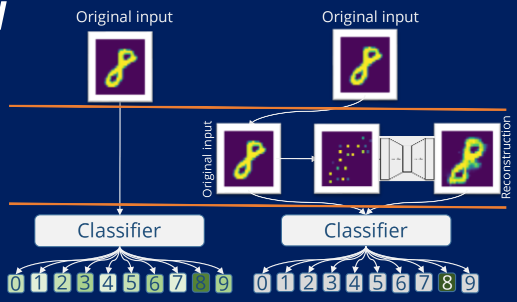
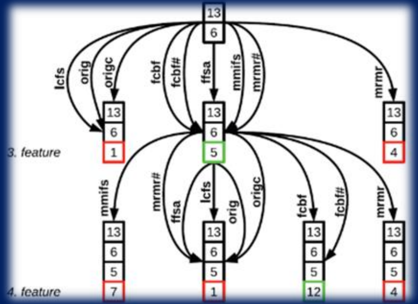
Research fields

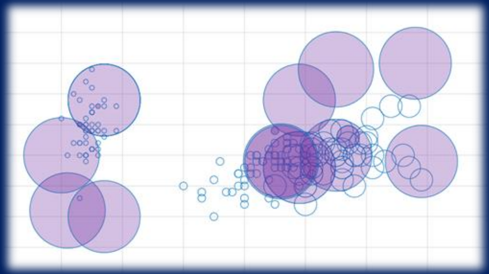
MICS-EFS: Model Input-Output Configuration Search with Embedded Feature Selection



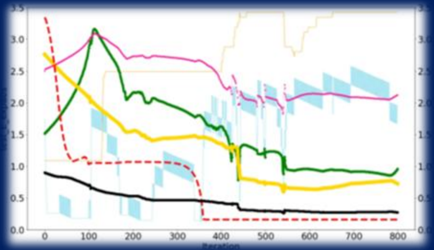
AHFS: Adaptive, Hybrid Feature Selection



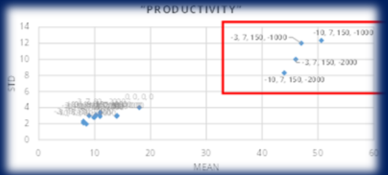
IDOD: Outlier Detection Algorithm Based on Missing Data Handling



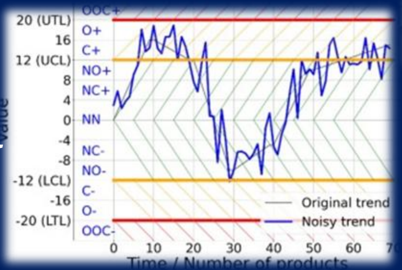
Self-Adaptive, Dynamic, Integrated Statistical and Information Theory Learning



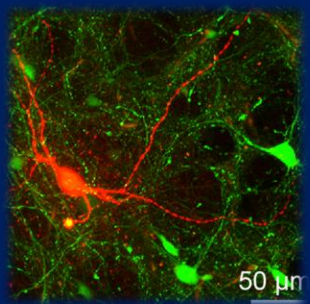
Extension of Reinforcement Learning for Production cell Optimization



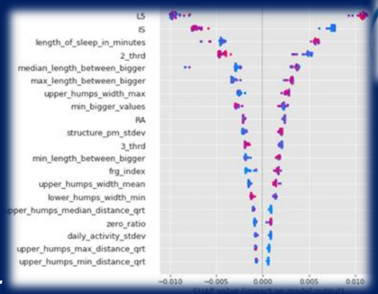
Extension of Reinforcement Learning for Manufacturing Quality Control



Classification of Kolinerg Neuron Cells by Machine Learning Techniques (AHFS)



Identification of Premorbid latent Schizophrenia and Bipolar Disorder by Machine Learning



Follow-up Projects and Developments

COPROLOGS

AI EDIH Hungary

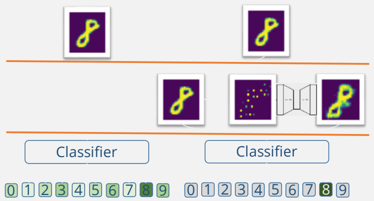
AI EDIH

Federal Ministry Innovation, Mobility and Infrastructure Republic of Austria

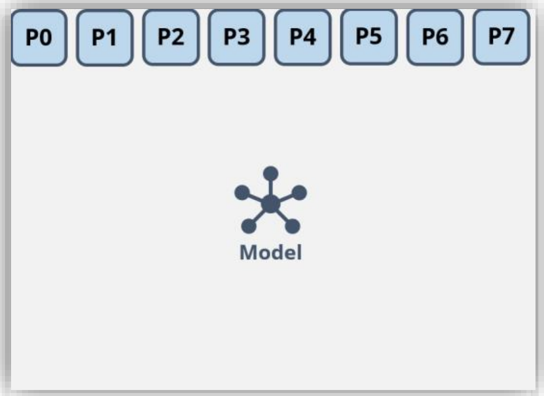
REINFORCE

DiGreeS

MICS-EFS: Model Input-Output Configuration Search with Embedded Feature Selection

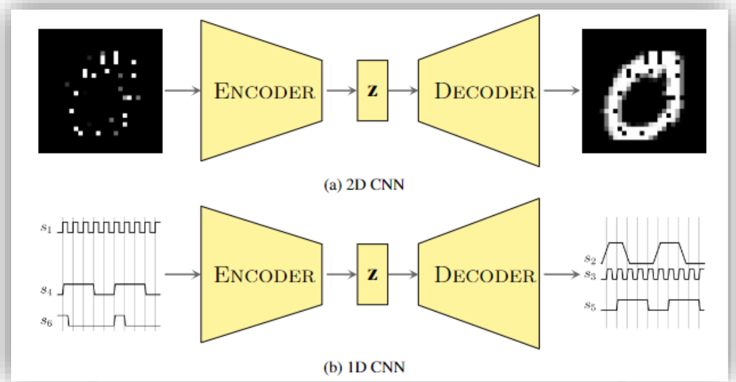


Challenge



- Given **parameters** and a **learning model**
- *Input-Output* ***configuration search***
- **Input Search**:
  - **~Embedded Feature Selection**
- **Output Search:**
  - **~Embedded Feature Pruning**

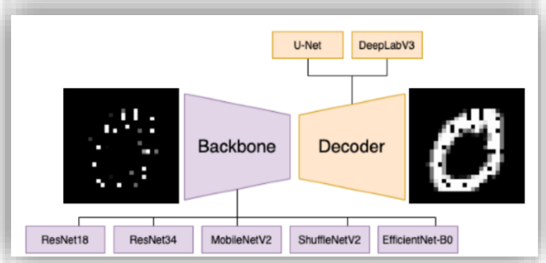
Solution

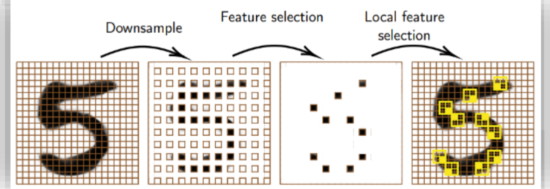


- **Solution: encoder-decoder**
  - Finding **optimal input - output** configurations
- **Extension**
  - For different type of **multimodal data**: ***image*** and ***signal***
  - **Different learning models** (CNN, Transformers)
  - **Hierarchical solution** (faster training speed)

Effect

Dataset	Reference CNN	MICS-EFS
MNIST	98.5	**98.6**
MNIST (with noise)	79.8	**80.5**
Fashion MNIST	90.5	**90.9**
CIFAR10	65.0	**66.1**
MHealth	97.0	**98.1**
HAR Smartphone	80.3	**80.6**
Opportunity	43.0	**47.5**
Skoda Mini Checkpoint	93.8	**98.9**
MIT-BIH	96.3	**98.0**

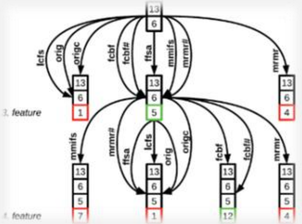




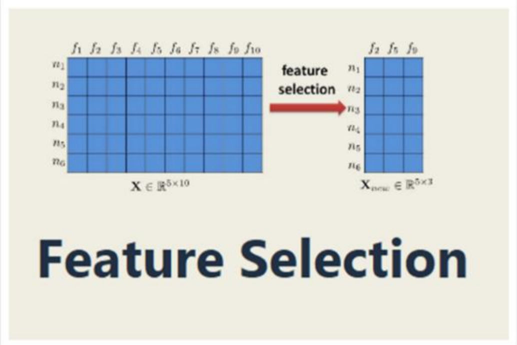
- **Advantages**
  - **Outperforms** State-of-the-Art FS **algorithms**
  - **Inclusion** of Pre-trained **State-of-the-Art neural network structures**
  - **Reduction of the execution time**

[1] **Anh Tuan Hoang, Zsolt János Viharos**: Novel Deep Neural Architecture Search Algorithm for Human Activity Recognition, ***ERCIM News***, 2023
[2] **Anh Tuan Hoang, Zsolt János Viharos**: Model Input-Output Configuration Search with Embedded Feature Selection for Sensor Time-series and Image Classification, ***IEEE Access***, 2025
[3] **Anh Tuan Hoang, Zsolt János Viharos**: Robust Superiority of the MICS-EFS Configuration Search Algorithm through Modular Extensions of Complex Neural Architectures, ***IEEE 19th International Symposium on Applied Computational Intelligence and Informatics***, 2025

AHFS: Adaptive, Hybrid Feature Selection

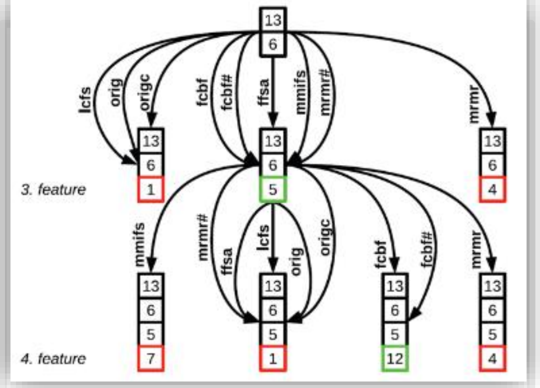


Challenge



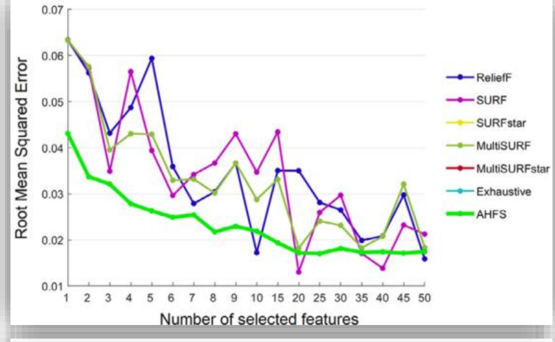
- **Curse of Dimensionality**
  - High-dimensional datasets
  - **More features ≠ better model**
- **Feature Selection (FS)**
  - Selecting a **subset of relevant** and **informative** features
  - **Removes** *irrelevant* or **redundant** features

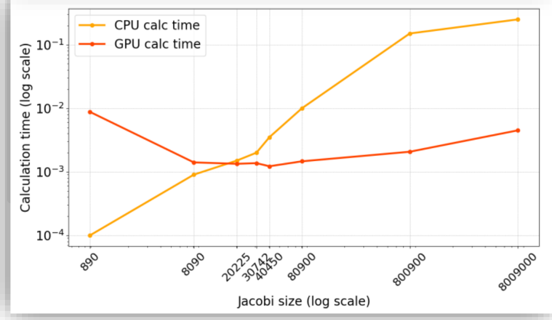
Solution



- **Solution: AHFS**
  - **A**daptive, **H**ybrid,
  - **F**eature **S**election
- **Key idea: parallel search:**
  - **Feature** space **&**
  - **Separation measure's** space
- **Components**
  - **Calculation** of **separation measures**
  - **Neural network training**
  - **Forward** selection

Effect

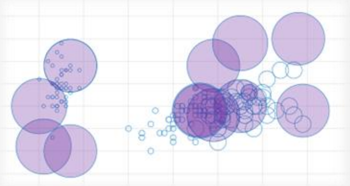




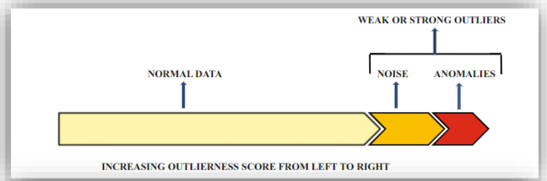
- **Advantages**
  - **(Over) State-of-the-art feature order**
  - Good **scalability**
  - **Easy to extend** in many aspects
  - **Freely available** / for download

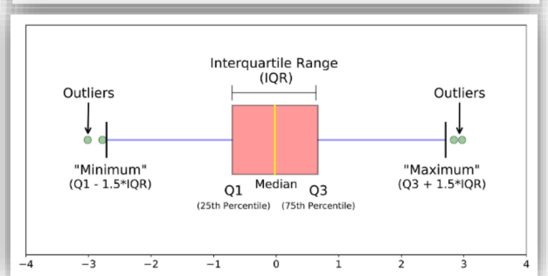
[1] **Viharos, Zs J; Kis, K B; Fodor, Á; Büki, M Á**: Adaptive, Hybrid Feature Selection (AHFS), ***PATTERN RECOGNITION***, 116 Paper: 107932 , 13 p. (2021)
[2] **Gercuj, Bence ; Hoang, Anh Tuan ; Viharos, Zsolt János**: Towards a Modular Redesign of the Scalable Adaptive Hybrid Feature Selection Algorithm, ***IEEE 23rd International Symposium on Intelligent Systems and Informatics (SISY 2025) :*** Proceedings, IEEE (2025) 461 p. pp. 000369-000374. , 6 p.

IDOD: Outlier Detection Algorithm Based on Missing Data Handling



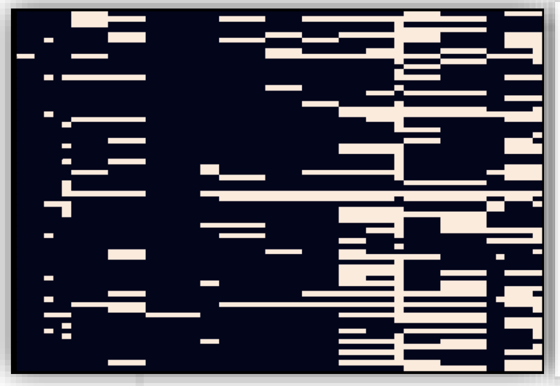
Challenge

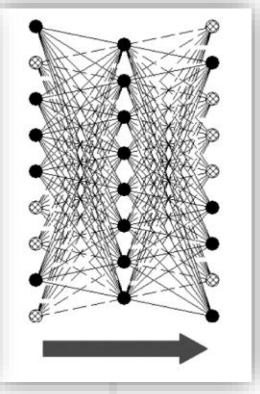




- **Identify observations**
  - "appear to be ***inconsistent*** with the ***remainder*** of the ***data***"
- Anomalies **are much rarer** than normal data
  - ***Normal data*** dependent
- ***Assignment dependent solution***
  - Banking, healthcare, cybersecurity…

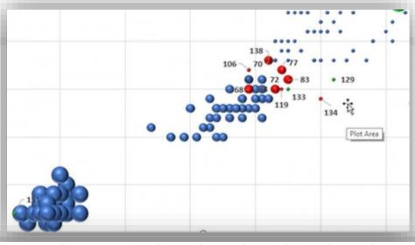
Solution





- **Solution**
  - **HIDD**: ***Handling Incomplete Data Directy***
  - A neural network ***training*** algorithm ***on missing*** data
- **Core idea**
  - ***Setting suspected outliers as missing***
  - It shall improve the overall model error
- ***Assignment dependent***
  - So far, ***no such algorithm was seen in the state-of-art***

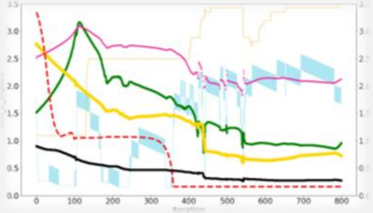
Effect



Output	3|8|11				
	Rec	Ind	Real	Task	Weak
Global outliers	100%	100%	100%	100%	100%
Local	83%	77%	67%	100%	75%
Collective	100%	100%	100%	100%	100%
Dependency	83%	83%	67%	100%	100%
Total	93%	92%	96%	87%	98%

- **Advantages**
  - ***Explanation*** for the ***outlierness***
    - ***what feature is the main cause*** for being classified as an outlier
  - Using the missing data handling is might uncover ***masked outliers***
  - Identifying ***outliers in inputs and outputs***

[1] **Hamdi Fatma**: Outlier Detection Algorithm Based on Missing Data Handling ***TDK manuscript***, BME (2021) **Supervisor: Dr. Zsolt János Viharos**
[2] **Hamdi Fatma**: Incomplete Data based Outlier Detection (IDOD), ***MNB-BME Kutatási verseny és egyetemi ösztöndíj***, MNB-BME (2022) **Supervisor: Dr. Zsolt János Viharos**
[3] **Hamdi Fatma**: Novel Outlier Detection Algorithm Based on Incomplete Data Handling ***TDK manuscript, III. prize***, BME (2023) **Supervisor: Dr. Zsolt János Viharos**



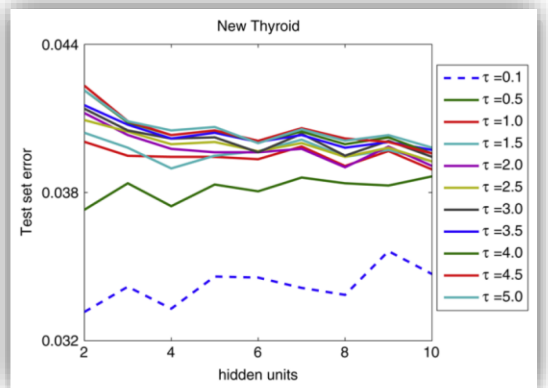
Self-Adaptive, Dynamic, Integrated Statistical and Information Theory Learning

Challenge

Accuracy	MSE	SE	CE	CorrE	RE(2)	MI	J	JS	E_{Exp}
MSE		++	∘ +++ ∘	++ ∘	+	+	∘	∘	+
CE	∘ + ∘	+					∘	∘	
CorrE	+ ∘								
RE(2)				+					
ZED(M)		+			+				
J	∘		∘						
JS	∘		∘						
E_{Exp}	+		+						
Summary	8	4	8	4	2	1	2	2	1

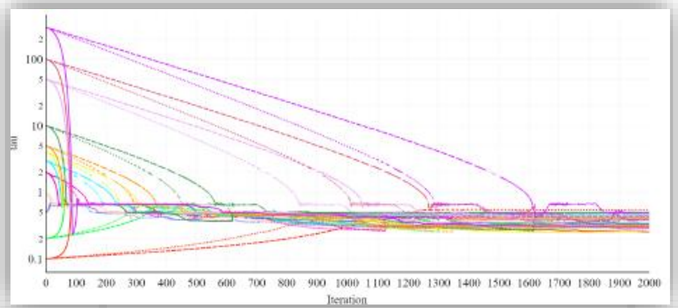
- **Several error measures**
  - ...for ***neural network*** training, ***as well***
  - **Various advantages and disadvantages**
- **Exponential Error (EExp)**
  - ***Integration*** of ***two, most frequent measures*** (RMSE, Cross-Entropy)
  - But: ***fixed weighting***

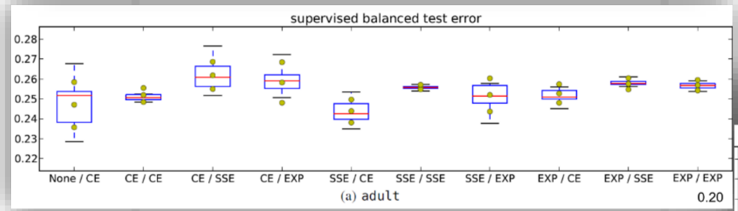
Solution

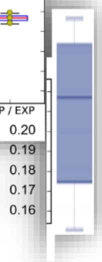


- **Solution**
  - Introduction of ***dynamic weighting*** of the measures ***during training***
- **Core idea**
  - ***Novel error equation***
  - ***Inclusion*** *of the* ***weight as learning parameter***
- ***Extension*** *of the Levenberg-Marquardt* ***learning algorithm***

Effect







- **Advantages**
  - ***Learning speed*** *(significant)* ***improvement***
  - ***Model accuracy improvements***

[1] **Viharos, Zs. J.; Szűcs, Á. (2022):** Self-Adaptive, Dynamic, Integrated Statistical and Information Theory Learning, ***arXiv***, https://arxiv.org/abs/2211.11491

[2] **Szűcs Ágnes**: Statisztikát és információelméletet integráló mértéket alkalmazó dinamikus algoritmus mesterséges neurális hálózat tanítására ***TDK manuscript, III. Prize,*** (2022)
Supervisor: Dr. Zsolt János Viharos

[3] **Szűcs Ágnes**: Statisztikát és információelméletet integráló mértéket alkalmazó dinamikus algoritmus mesterséges neurális hálózat tanítására ***OTDK manuscript, II. Prize,*** (2023)
Supervisor: Dr. Zsolt János Viharos

Extension of Reinforcement Learning (RL) for Manufacturing Quality Control

Challenge

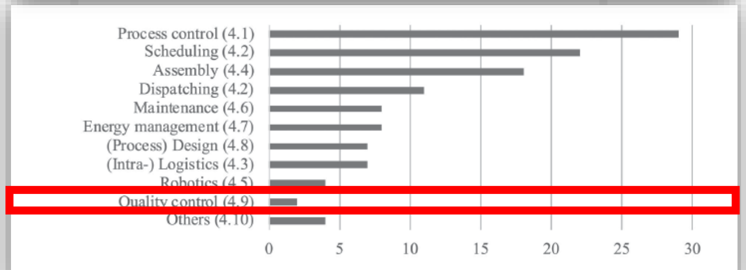
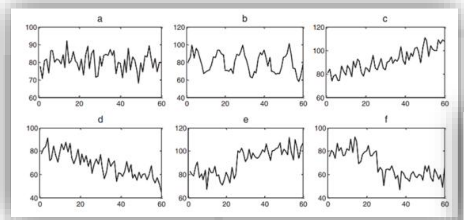
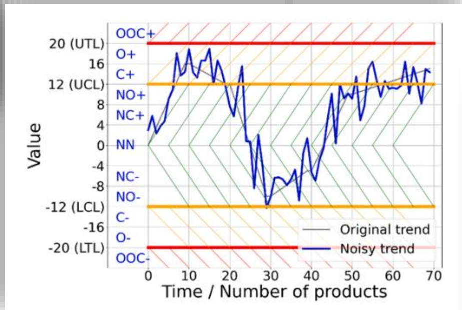


Figure 6. Number of publications allocated to the production disciplines.

- **Production quality control**
  - **Varying human invetions**
  - Interventions at **predefined cycle times**
  - **Cost saving**

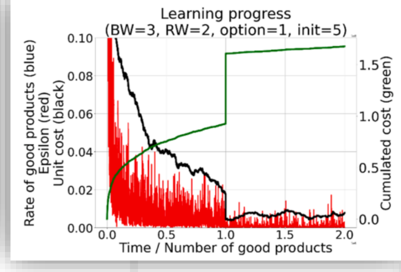
Solution

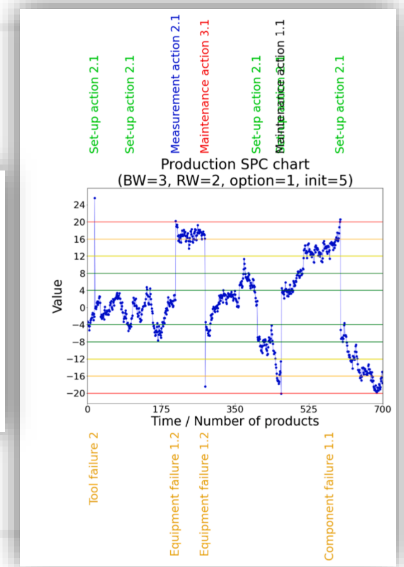




- **Solution**
  - Collection of humans' interventions
  - ***Simulation model of the quality circle (statistical model)***
  - ***The production costs as reward***
- **Core idea**
  - ***Applying the stochastic RL model***
  - ***Developing adaptive, self control for the RL algorithm***

Effect





- **Advantages**
  - ***Human "independent"*** *production control*
  - ***Situation dependent (and continuous)*** *production control*
  - *Significantly* ***less interventions***
  - ***Smaller cost***
  - ***Very good quality*** *inside the quality control chart*

[1] **Viharos, Zs J; Jakab, R**: Reinforcement Learning for Statistical Process Control in Manufacturing, ***MEASUREMENT***, 182 Paper: 109616 , 18 p. (2021)
[2] **Pálvölgyi Bence**: Új, dinamikus, önszabályzó megerősítéses tanulási algoritmus kidolgozása és gyártási alkalmazása a statisztikai minőségirányítás területén, ***TDK manuscript***, III. Prize, (2023) **Supervisor: Dr. Zsolt János Viharos**

Extension of Reinforcement Learning (RL) for Production cell Optimization

Challenge

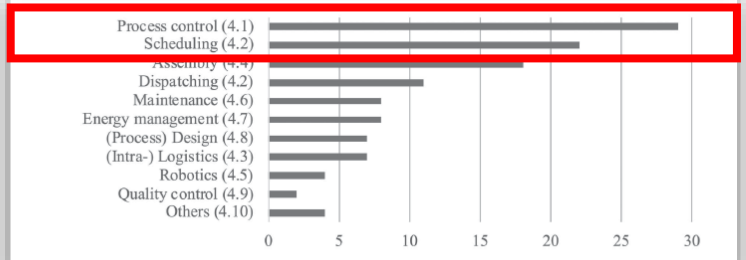


Figure 6. Number of publications allocated to the production disciplines.

- **Production cell control**
  - **Fixed rules – *optimal ??***
  - **Logistics & machining**
  - **→Machine learning**

Solution

Gymnasium

RL Algorithms

This table displays the rl algorithms that are implemented in the Stable Baselines3 project, along with some useful characteristics: support for discrete/continuous actions, multiprocessing.

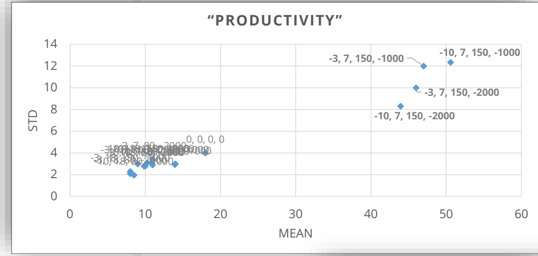
Name	Box	Discrete	MultiDiscrete	MultiBinary	Multi Processing
ARS [1]	✔	✔	✘	✘	✔
A2C	✔	✔	✔	✔	✔
CrossQ [1]	✔	✘	✘	✘	✔
DDPG	✔	✘	✘	✘	✔
DQN	✘	✔	✘	✘	✔
HER	✔	✔	✘	✘	✔
PPO	✔	✔	✔	✔	✔
QR-DQN [1]	✘	✔	✘	✘	✔
RecurrentPPO [1]	✔	✔	✔	✔	✔
SAC	✔	✘	✘	✘	✔
TD3	✔	✘	✘	✘	✔
TQC [1]	✔	✘	✘	✘	✔
TRPO [1]	✔	✔	✔	✔	✔
Maskable PPO [1]	✘	✔	✔	✔	✔

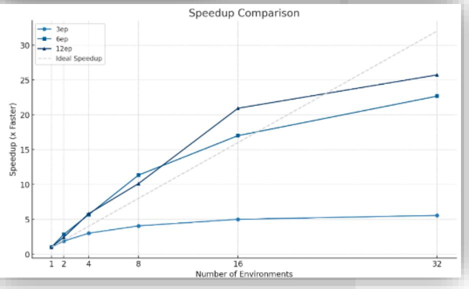
[1] (1, 2, 3, 4, 5, 6, 7) Implemented in SB3 Contrib

- **Solution**
  - ***Applying*** well-prepared, ***state-of-the-art IT environments*** and solutions (by Open-AI)
- **Core idea**
  - ***Integration of production know-how into the*** *reinforcement* ***learning process***
- ***Identification*** *the most* ***fitting*** *appropriate* ***RL algorithm***

Effect

Maskable PPO [1]	✘	✔	✔	✔	✔

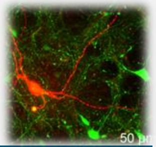




- **Advantages**
  - *Proposed algorithm:* ***MaskablePPO***
  - ***Action masking****:* ***Extended internal logic***
  - ***Hyperparameter search****: reward weights & initial network parameters*
  - *Robustness (and speed):* ***Parallelization***

[1] **Laflamme, C; Doppler, J ; Palvolgyi, B ; Dominka, S ; Viharos, Zs J**; Haeussler, S: Explainable reinforcement learning for powertrain control engineering, ***ENGINEERING APPLICATIONS OF ARTIFICIAL INTELLIGENCE*** 146 Paper: 110135 , 12 p. (2025)
[2] **BENCE PÁLVÖLGYI, DR. ZSOLT JÁNOS VIHAROS, JENŐ CSANAKI, KRISZTIÁN MESKÓ, ZSOLT NAGY**: PRODUCTION CELL OPERATION OPTIMIZATION BY REINFORCEMENT LEARNING, ***Gyártás 2025 Konferencia*** (2025), presentation
[3] **ZSOLT JÁNOS VIHAROS, JENŐ CSANAKI, KRISZTIÁN MESKÓ, ZSOLT NAGY**: PRODUCTION CELL OPERATION OPTIMIZATION BY REINFORCEMENT LEARNING, ***HUNGARIAN JOURNAL OF INDUSTRY AND CHEMISTRY,*** (2025), under review

Classification of Kolinerg Neuron Cells by Machine Learning Techniques (AHFS)



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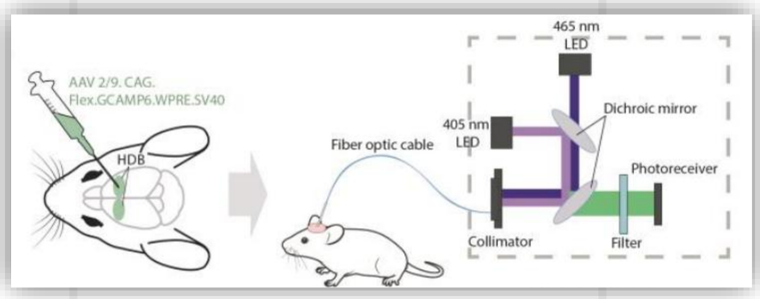
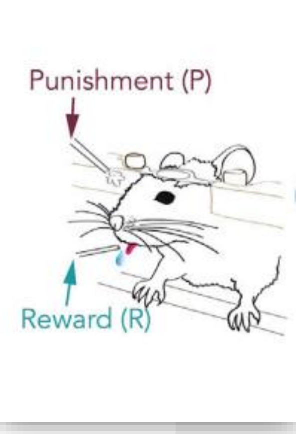
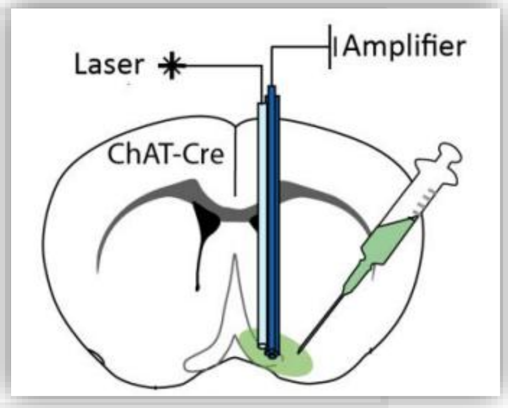
Challenge



- State-of-the-art: **Two kinds of koinerg neuronal cells** (not only one)
    - **Discovered by Balázs Hangya et al.**
        - DSc defense: 2025.10.27 (100%)
        - EU ERC awarded
- **Questions**
    - **Which gene-s determine this two types** of kolinerg neuron cells (**…of 11 000…**)
    - **Many other questions**…e.g. transmitters, projection fields of the two different neuron types…

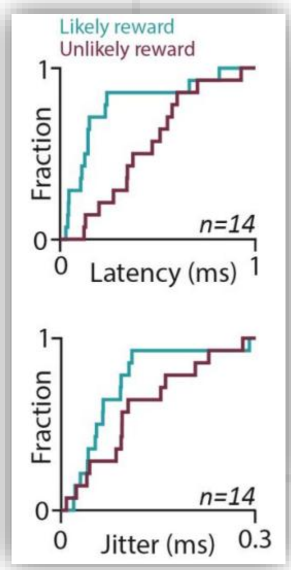
Solution

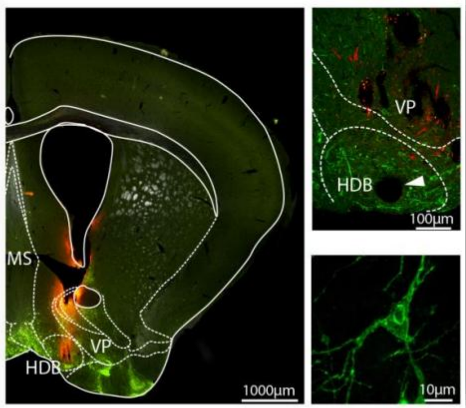




- **Solution**
    - Various (not high number) of **brain neuron experiments** (in-vio, in-vitro)
        - ***Mouse, Monkey, Dog, Human***
- ***Identification of the important genes (23)***
    - *Applying the **AHFS algorithm***
    - ***Tests** based on **feasible** and **relevant genes (using viruses)***

Effect





- **Advantages**
    - ***Identified and approved genes***
    - *Targeted **experiments** on various **animals and humans***
    - ***Answers** for many other questions (**projection, transmitters**…)*

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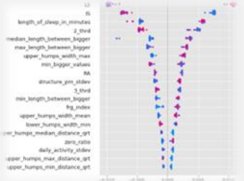
Ref.: **Panna Hegedüs, Katalin Sviatkó, Bálint Király, Sergio Martínez-Bellver, Balázs Hangya**: Cholinergic activity reflects reward expectations and predicts behavioral responses, *iScience*, Volume 26, Issue 1, 2023, 105814, ISSN 2589-0042, https://doi.org/10.1016/j.isci.2022.105814.
[1] Publication in preparation (c1)

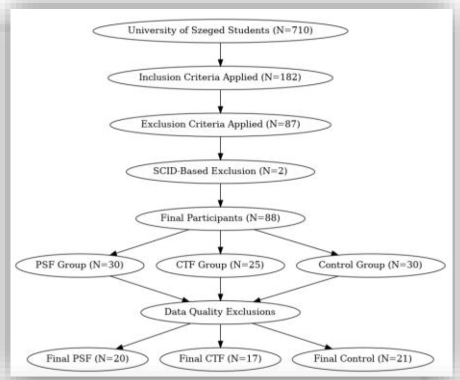
Identification of Premorbid latent Schizophrenia and Bipolar Disorder by Machine Learning

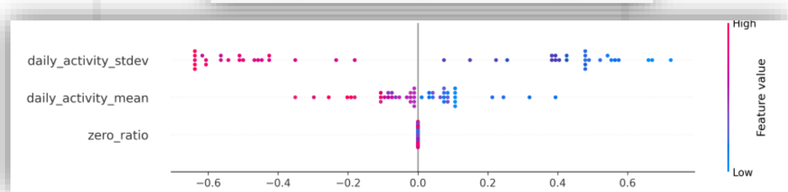
UNIVERSITY OF SZEGED

Kiskunhalasi Semmelweis Kórház
a Szegedi Tudományegyetem Oktató Kórháza



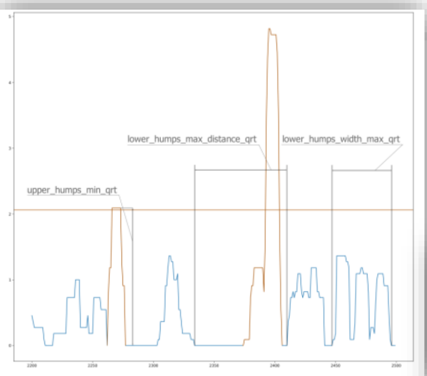
Challenge

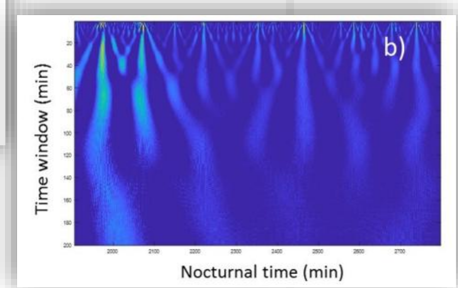




- **Identification of disease in premorbid stage (before the disease)**
  - Human **movement dependent**…
  - Human **brain activity dependent**..
  - ***What signals? How?***

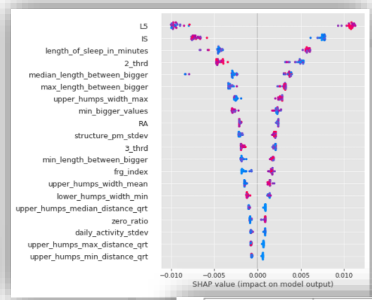
Solution

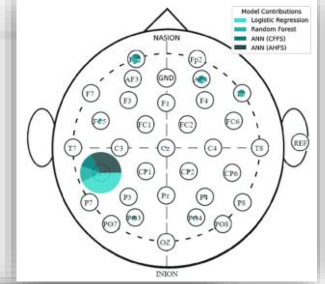


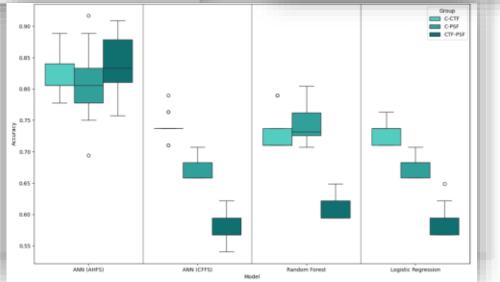


- **SZTE experiments**
  - Various tests **by psychologists**
  - ***Using the Actigraph***
  - ***Using EEG***
- **Core idea**
  - ***Feature generation***
  - ***Feature selection by the AHFS algorithm***

Effect







- **Advantages**
  - ***Detected, important***
    - ***Movements***
    - ***Brain activities***
  - *…for **premorbid** and also **for morbid** phases*
  - *Identified relevant **brain fields***
  - ***Very quick (and early) detection methods***
  - ***Patent in preparation***

[1] **László, Sz ; Nagy, Á ; Dombi, J ; Hompoth, E A ; Rudics, E ; Szabó, Z ; Dér, A ; Búzás, A ; Viharos, Zs J ; Hoang, A T et al.**: The two ends of the spectrum: comparing chronic schizophrenia and premorbid latent schizotypy by actigraphy, ***BMC PSYCHIATRY*** 25 : 1 Paper: 531 , 17 p. (2025)
[2] **Gubics, F ; Nagy, Á ; Dombi, J ; Pálfi, A ; Szabó, Z ; Viharos, Zs J ; Hoang, A T ; Bilicki, V ; Szendi, I**: A Machine-Learning-Based Analysis of Resting State Electroencephalogram Signals to Identify Latent Schizotypal and Bipolar Development in Healthy University Students, ***DIAGNOSTICS*** 15 : 4 Paper: 454 , 36 p. (2025)
[3] **Nagy, Á; Dombi, J ; Fülep, M P ; Rudics, E ; Hompoth, E A ; Szabó, Z ; Dér, A ; Búzás, A ; Viharos, Zs J ; Hoang, A T et al.:** The Actigraphy-Based Identification of Premorbid Latent Liability of Schizophrenia and Bipolar Disorder, ***SENSORS*** 23 : 2 Paper: 958 , 25 p. (2023)

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A Machine-Learning-Based Analysis of Resting State Electroencephalogram Signals to Identify Latent Schizotypal and Bipolar Development in Healthy University Students

Gubics, F; Nagy, Á; Dombi, J; Pálfi, A; Szabó, Z; Viharos, Zs J; Hoang, A T; Bilicki, V; Szendi, I

Gépi tanulás algoritmusainak átfogó tesztelése

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Model Input-Output Configuration Search with Embedded Feature Selection for Sensor Time-series and Image Classification

Hoang, Anh Tuan; Viharos, Zsolt János

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Hoang, A T; Viharos, Zs J

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The two ends of the spectrum: comparing chronic schizophrenia and premorbid latent schizotypy by actigraphy

László, Sz; Nagy, Á; Dombi, J; Hompoth, E A; Rudics, E; Szabó, Z; Dér, A; Búzás, A; Viharos, Zs J; Hoang, A T et al.

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Gercuj, Bence; Hoang, Anh Tuan; Viharos, Zsolt János

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Tóth, Sz H; Bárdos, Á; Viharos, Zs J

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Self-Adaptive, Dynamic, Integrated Statistical and Information Theory Learning

Zsolt János Viharos ; Ágnes Szűcs

Gépi tanulás algoritmusainak átfogó tesztelése

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Adversarial Reinforcement Learning for Circular Autonomous Drifting Under Drivetrain Uncertainty	Tóth et al.	2025
Explainable reinforcement learning for powertrain control engineering	Laflamme et al.	2025
Sim-to-Real Application of Reinforcement Learning Agents for Autonomous, Real Vehicle Drifting	Tóth et al.	2024
Unlocking insights from actigraphy: examining feature selection and activation detection approaches for enhanced data int...	László et al.	2024
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Investigation of ductile/brittle chip formation zone in the context of manufactured geometry with different CAM paths strat...	Móricz and Viharos	2022
Vibration-based tool life monitoring for ceramics micro-cutting under various toolpath strategies	Viharos et al.	2021
Adaptive, Hybrid Feature Selection (AHFS)	Viharos et al.	2021
Reinforcement Learning for Statistical Process Control in Manufacturing	Viharos and Jakab	2021
Microsecond measurement resolution for process cycle diagnostics of micro-EDM milling	Viharos and Farkas	2021
Vibration based characterization of tool wearing in micro-milling of ceramics	Móricz and Viharos	2021
Integrating maintenance strategies in autonomous production control using a cost-based model	Glawar et al.	2021
Reinforcement Learning for Statistical Process Control in Manufacturing	Viharos and Jakab	2020
Off-line Geometrical and Microscopic & On-line Vibration Based Cutting Tool Wear Analysis for Micro-Milling of Ceramics	Móricz et al.	2020
Effect of CAM Path Strategies on Tool Life in Ceramics Micro-Cutting	Móricz et al.	2020
Product quality and cutting tool analysis for micro-milling of ceramics	Móricz et al.	2019

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Saját projektek

Keresés - Állapot - - Telephely - Keresés

Projekt neve	Intézmény	Projekt vezetője	Telephely	Projektzárás	Beküldés ideje	Módosítva ↑	Állapot	
Gépi tanulás algoritmusainak átfogó tesztelése	HUN-REN Számítástechnikai és Automatizálási Kutatóintézet	Dr. Viharos Zsolt János	SZTAKI	2026-03-31	2021. jan. 19. 15:57	2025-03-13 18:00	Futó	Szerkesztés

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Nyitott kutatási lehetőségek

Szükséges a megfelelő számítási háttér is!

Részvételi lehetőség felfedező kutatásokban:
***hallgatók* számára**

Kutatási lehetőség hallgatóknak

Kutató orientáltságú hallgatókat keresek, akik szívesen dolgoznak kutatási környezetben és kedvelik a felfedező kihívásokat.

Általános feladatok:

- Új számítási algoritmusok (irányított és részben közös) kidolgozása.
- Implementálás (Python, esetleg C++ környezetben).
- Átfogó tesztelés, irodalomkutatás, összevetés más publikált eredményekkel.
- Korrekciók, hangolás, az eredmények dokumentálása és publikálása.
- Megfelelő eredmények esetén bekapcsolódás az intézet futó kutatás-fejlesztési és ipari projektjeibe.

Kutatási témák

- ***Neuro-fuzzy* modellek (ANFIS) input/output struktúrájának tanulása és hatékony paraméterkeresés kidolgozása.**
- **Levenberg-Marquardt neurális tanító algoritmus *gyorsítása adaptív technikákkal*, adaptív, dinamikus, *integrált mértékek* mesterséges neurális háló modell(ek) tanításában.**
- Neurális hálók tanítása hiányos adatokkal, Levenberg–Marquardt algoritmussal – hatékony „kipótló" algoritmus kidolgozása. (már megkezdődött)
- Adaptív, hibrid jellemzőválogatás keresési algoritmusának gyorsítása, párhuzamosítása, információelméleti kiterjesztés. (már megkezdődött).
- Nemlineáris kísérlettervezés algoritmusának továbbfejlesztése, mérésszám-csökkentés. (már megkezdődött).
- Mesterséges neurális háló alapú outlier detektálás és elimináció (már megkezdődött).
- Deep Learning technikájú input/output keresés, modellépítés (már megkezdődött).
- Automatikus részmodellre bontás algoritmusának továbbfejlesztése, hatékonyságának növelése (már megkezdődött).
- Felfedező tanulás alapú drift mozgásszabályzó rendszer önvezető járműhöz (már megkezdődött).
- Reinforcement Learning alkalmazása a termelésben és minőségirányításban (már megkezdődött).

Elvárások:

- Angol nyelv ismerete: tudományos cikkek gyors olvasása és értelmezése, angol nyelvű dokumentálás

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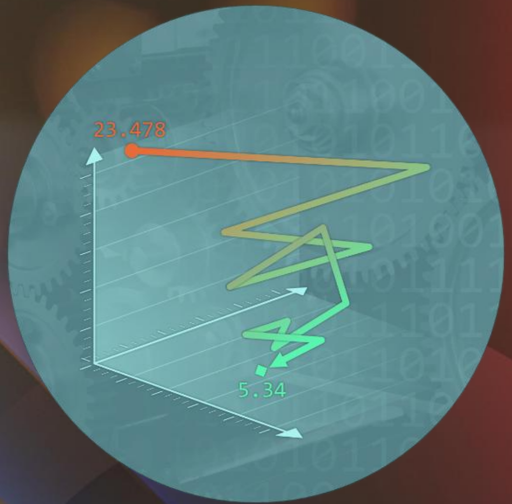

Gépi tanulás algoritmusainak átfogó tesztelése

HUN-REN Institute for Computer Science and Control (HUN-REN SZTAKI)
Research Laboratory on Engineering and Management Intelligence, Intelligent Processes Research Group

Dr. Zsolt János Viharos

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