

ACADEMIC PARTNERS



RESEARCH GROUPS AND SCHOLARLY ORGANIZATIONS



INDUSTRIAL PARTNERS



ABOUT IRT SYSTEMX

SystemX is a technological research institute (IRT) with expertise in the fields of analysis, modelling, simulation and decision support for complex systems. As the only IRT dedicated to digital systems engineering, it coordinates partnership research projects, bringing together academics and industry in a multi-sector perspective. Together, they work to solve major scientific and technological problems in four priority application sectors: Mobility and Autonomous Transport, Industry of the

Future, Defence and Security, Environment and Sustainable Development. Through use-case oriented projects, SystemX's research engineers respond to the major societal and technological challenges of our time, and thus contribute to the acceleration of the digital transformation of industries, services and territories. Located at the Paris-Saclay plateau and in Lyon, SystemX was created in 2012 as part of the future investment programme.

IN THE TEAMS

24 research engineers
13 PhD projects
7 of which were defended

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CONTACTS



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EXPERTISE

Data storage and management, statistical analysis, data augmentation, machine learning (supervised/unsupervised/reinforcement/active), deep learning, robust models, evaluation of learning models,

hybrid learning models, representation learning, transfer learning.



Data Science and AI

INFORMATION SHEET

Data-driven approach to reality

The widespread deployment of communicating and precise measurement systems, coupled with efficient data storage solutions, makes the approach of external observation of complex systems realistic.

Statistical learning techniques are particularly efficient. The functionalities they offer are robust, parsimonious and scalable.

These techniques allow for an efficient modelling of how the systems work, whether it is for classification, detection, prediction or causality research purposes.

Finally, they can be applied to many kinds of data (signals, images, videos, texts, speech, relational data, graphs, log data, dynamic data, sequences, etc.).



CHALLENGES

Companies must take up the challenge of creating value by exploiting available data by focusing on the optimisation of internal processes and the creation of new services for their customers.

POSITIONING OF THE INSTITUTE

IRT SystemX focuses on data science and artificial intelligence in its R&D projects. In industrial systems and services, data engineering and learning mechanisms provide decision support in the design and operation phases, by being integrated into processing chains. A second strand of research is the hybridization of learning solutions with knowledge models or physical models.

Moreover, the institute has a specific interest in the confidence and robustness of systems integrating AI, particularly in the context of critical systems



Projects in this field



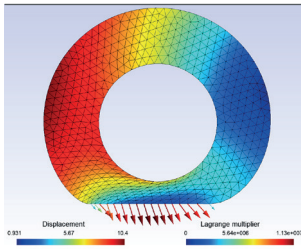
DOS project

On the design and validation of Obstacle Detection and Railway Side Signalling systems

- Safety qualification method of the overall perception system
- Performance improvement of the obstacle detection system

EPI project
On the evaluation and optimisation of the performance of AI-based decision systems for the automotive and maritime industries

- Robustness evaluation approach of Deep Learning for the steering function
- Robust learning approach for Deep Learning



HSA - IA2 project
On the hybridization of Physical Simulations and Machine Learning methods for the aeronautics, energy and transport sectors

- Reducing the cost of simulation by creating surrogate models based on statistical learning
- Improving the quality of decisions made in simulation-based design phases
- Solving difficult physical problems under time constraints

IVA project
On Augmented Passenger Information: optimising multimodal travel in the Ile-de-France transport network

- Knowledge of the state of the transport system in the short and medium term
- Development of an AI-based mobility assistant



Platforms and demonstrators



DebiAI
Environment for data set quality and use in learning models

- Characterising and summarising data
- Evaluate weaknesses in a data-driven model
- Identify global or local biases
- Selecting data (according to contexts) for dataset building: train/test/validation



Roadmap

SCIENTIFIC AND TECHNOLOGICAL CHALLENGES

Engineering of data and learning model

RELATED RESEARCH FIELDS

- Data and model life cycle
- Model traceability/repeatability
- Learning data development engineering
- Knowledge acquisition, management and use
- Model and algorithm embeddability

Hybridization of learning models

- With physical models
- With business knowledge
- With graph theory
- With control theory
- With multi-agent simulation
- Hybrid component system

Confidence and robustness of learning models

- Interpretation of models and explanation of decisions
- Characterisation of the operational domain covered by the data
- Evaluation of learning models with application and functional metrics
- Robust learning models

Learning in a specific context

- Federated or distributed learning
- Privacy-preserving learning
- Incremental learning
- Representation learning
- Generative models and unsupervised approaches
- Transfer learning and conditions of its applicability

Target of IRT SystemX publications in this field (HAL collection)

● JOURNALS

Journal of Machine Learning Research, Pattern Recognition, Neural Computing and Applications, Revue des Sciences et Technologies de l'Information, International Journal of Performability Engineering, Energies

● CONFERENCES

NeurIPS (Neural Information Processing Systems), ECML PKDD (European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases), ICAAI (International Conference on Advances in Artificial Intelligence), ICTAI (IEEE International Conference on Tools with Artificial Intelligence), ACML (Asian Conference on Machine Learning), ICONIP (International Conference on Neural Information Processing), IEEE ICMLA (International Conference on Machine Learning and Applications), IEEE SMC (Systems, Mans and Cybernetic society), IEEE GLOBECOM

(Global Communications Conference), IEEE IVS (Intelligent Vehicles Symposium), EKAW (European Knowledge Acquisition Workshop), ICWSM (International AAAI Conference on Web and Social Media), CORIA (Conférence en Recherche d'Information et Applications), META (International Conference on Metamaterials, Photonic Crystals and Plasmonics), SSD (International Multi-Conference on Systems, Signals and Devices), SciPy (Scientific Computing with Python Virtual Conference), WCRR (World Congress on Railway Research), ETC (European Transport Conference), TRA (Transport Research Arena), IEEE ITSC (International Conference on Intelligent Transportation Systems)