

Intelligent Systems Group

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Expertise area: AI research

1. Machine Learning

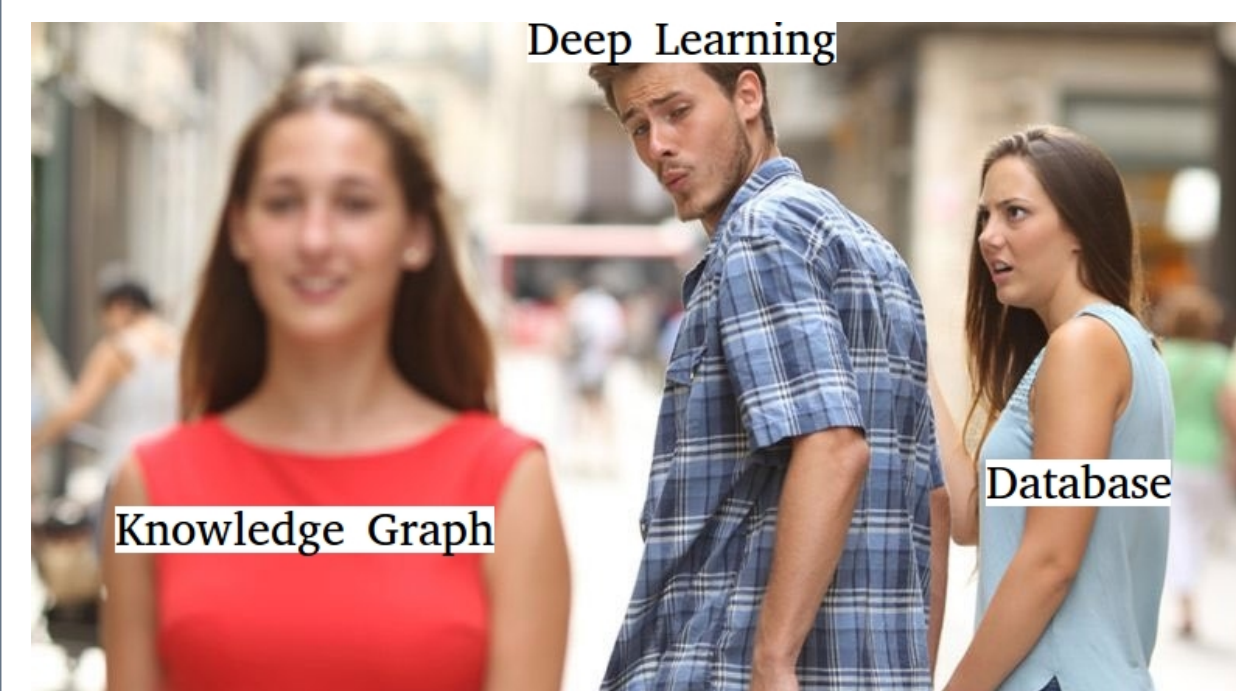
We know how **to torture data** to make a full confession



We master various torture instruments: CNN, RNN, GNN, SVM, PCA, Gradient Boosting Trees

2. Knowledge Graphs

We know how **to interleave deep learning with knowledge graphs**



We know how **to build domain ontologies**

Expertise area: AI applied

3. Natural Language Understanding

We know how **to analyse text to support precise reasoning and question answering**

Here is a puzzle for you: *In a scene from the Friends TV series, Monica is looking at Ross. Ross is looking at Rachel. Monica is married; Rachel is not. Is a married person looking at an unmarried one?*



Our NLU solutions are able to solve such texts
We know how **to adapt and fine tune language models** to specific problems

4. Image Processing

We know how:

- **to use encoded images** for sequences or volumes of images
- **to combine text with images**
- **to learn from labeled or unlabeled images** with contrastive learning, ViT, or Diffusion Models
- **to put ML to a diet**: with ablation studies, knowledge distillation, few shot learning



Services: Test before invest

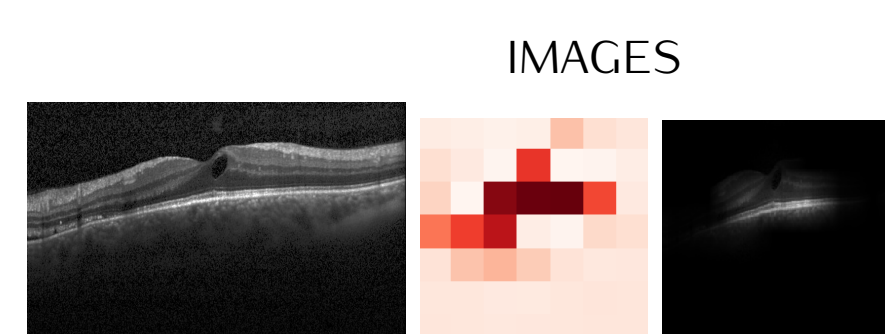
Access to specialists expertise

- Consulting on the AI Act of the European Commission
- Consulting, designing, researching and prototyping towards development of solutions which rely on: natural language processing, image processing, knowledge graphs, big data and data mining



Access to test digital technologies and concept validation or prototyping

- Prototypes for document digitalization, information extraction, textual similarity, textual entailment
- Prototypes for reasoning on knowledge graphs and ontologies
- Prototypes for medical assisted diagnosis
- Access to infrastructure for training big models
- Access to infrastructure for testing scalability in high performance computing



...expected from you:

- experience with utilizing and integrating **AI/ML** solutions and **APIs**, **Python**, **Java**
- experience with **automated testing** tools such as **JUnit**, **Cypress**, **JUnit5**, etc
- **Bachelor's Degree in Computer Science** (or closely related) and **12+ years** of relevant experience

Services: Training and Skills

More than 15 years of **teaching Artificial Intelligence** at the Computer Science Department

Using pretrained language models for: sentiment classification, document classification, question answering, named entity extraction, relation extractions, text generation, chatbots, finding similar documents, document digitalisation

Using existing NLP frameworks: Spacy, Huggingface, Fred

Using existing AI services: Azure cognitive services (speech, language, vision, decision), Google Natural Language AI, IBM Watson

Integration of knowledge graphs: generic domain (e.g. DBpedia, WikiData) or domain specific (e.g. Diseasesome, DrugsBank, Sider - Side effect resources, OrphaNET)

Build custom models for: image classification, image segmentation, object detection, image generation from text, text generation from image

Numerical data analysis: time series analysis (anomaly detection, fraud detection, trends detection, classification, prediction)

Use existing knowledge representation and reasoning tools: theorem provers, inference engines, engineering domain ontologies and knowledge graphs (Gremlin, RDF, OWL)

Significant solutions

Natural Language Processing

- Fact-checker with explanations
- Extract domain-specific named entities from text
- Chatbot for climate change
- Extract answers for a question from text or images
- Query medical linked data with natural language
- Sentiment and aspect-based sentiment analysis
- Detect sarcasm or automatic thoughts
- Text Generation

Deep Learning on Images

- OCT images for AMD understanding
- Detect COVID-19 in X Rays
- Pedestrian intention classification
- Sunquakes detection

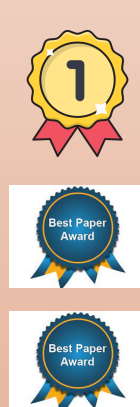
Knowledge representation and numerical data

- Detect geoeffective coronal mass ejections
- Traffic rule compliance
- Conformance checking against safety standards

Products

- Helping producers to check conformance against safety standards (e.g. HACCP – Hazard Analysis at Critical Control Points) from sensor data using Safety Cases, Goal Structuring Notation and Model Checking
- Helping drone producers to formally verify models with Model Checking
- Helping data analysts to efficiently discover hierarchies of patterns in sequential data using Relational Concept Analysis
- Helping HR recruiters to extract relevant information from CVs and job posts and to match the right candidate to the right job post using NLP and ML techniques
- Helping ophthalmologists in analysing retinal conditions: (i) classify 20 retinal conditions from eye fundus images with contrastive learning and CNNs; (ii) predict evolution of visual acuity for patients with AMD; (iii) identify potential new biomarkers from OCT volumes with contrastive learning
- Helping astrophysicists to detect sunquakes with autoencoders and contrastive learning from acoustic egression-power maps of solar active regions obtained for Solar Cycles 23 and 24 using the holography method

Awards:



- Question Answering Over Linked Data Task on Biomedical Data
- Agents that Argue and Explain Classifications of Retinal Conditions
- A Natural Language Processing System for Romanian Tourism

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