



LIFIA - Research and Innovation Center

Faculty of Informatics - National University of La Plata
Research Commission of the Buenos Aires Province (CIC)
La Plata, Argentina

Universidad Nacional de La Plata (UNLP)



- Created in 1897 in La Plata - Argentina
- Public, free, open and unrestricted access
- 17 Faculties - 120.000 students - 300 titles
- Has elementary, primary, secondary schools, radio station and a museum
- 2nd most prestigious in the country
- Alma mater to presidents and a Nobel



Faculty of Informatics

- Created in 1999 (first one in Argentina)
- 3 undergrad degrees (4.5 years)
 - Lic. Informatics, Lic. Systems
 - Eng, Computing
- 2 short titles (3 years)
- 5 Masters, 7 Specializations, and 1 Phd
 - **SE, HCI**, Data mining, Networks, HPC, Big data, IT in Education
- 14.500 students (2000 every year)
- 3 research labs (LIFIA, III-LIDI, LINTI)
- Two buildings (one dedicated to RD&TT)



LIFIA - Research and Innovation Center



<https://lifia.info.unlp.edu.ar/>
@LIFIAUnlp in Twitter
lifia_unlp on Instagram
info@lifia.info.unlp.edu.ar

- Created in 1988
- Research, Innovation, and Education
- Associated to UNLP and CIC-PBA
- 20 researchers (CONICET, CIC, UNLP)
- 15 Phd students, 20+ interns
- 40+ Innovation & Consulting staff
- 5 support and infrastructure staff
- Widespread international network
- Most active topics
 - Software engineering
 - Web engineering, web of data
 - HCI (UX, Gamification, Collaboration)
- Synergy with teaching at all levels

International collaboration

- International collaboration in LIFIA's DNA
- Multilateral projects
 - SticAmSud (FR)
 - DAAD/BMBF & MINCYT (DE)
 - CYTED (SP)
 - Horizon 2020, Horizon Europe (EU)
- Research stays (both ways)
- PhDs abroad, to return and enrich us
- Co-tutorships
- Organization of events and journals



Current projects/lines of work welcoming collaboration

- NLP of legal texts and requirement documents
- End-user adaptation of web browsers
- Automated detection of usability smells in web apps
- Automated adaptation of gamified interactions in collaborative science apps
- Haptic awareness in groupware systems
- ICT adoption in local horticulture
- Quantum Software Engineering
- Semantic Interoperability in agricultural residue limits regulation
- NPL and ontologies in requirements engineering
- Data visualization to introduce computational thinking in schools
- With industry - government
 - Crowdsourced data collection (citizen-science)
 - Web data for urban development
 - Data science applied to national budget planning
 - IT innovation in large government projects

Links with additional info

List of projects

- <https://memorias.lifia.ar/project-list>

Thesis

- <https://memorias.lifia.ar/thesis-list>

Publications and results

- <https://memorias.lifia.ar/center-profile>

Social media and web presence

<https://www.youtube.com/@lifia-unlp>

<https://twitter.com/lifiaunlp>

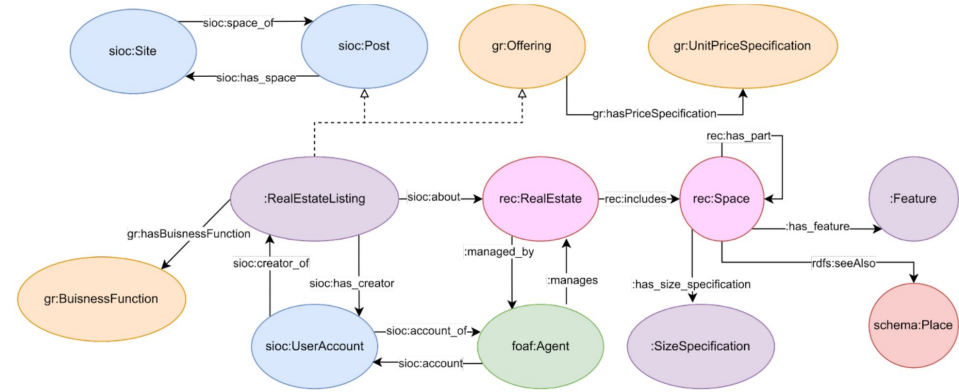
https://www.instagram.com/lifia_unlp

<https://www.linkedin.com/company/164734>

<http://www.lifia.info.unlp.edu.ar>

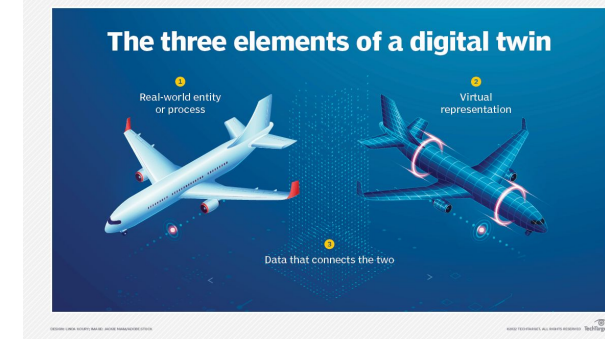
Land Value Observatory

- Joint project with LINTA (Territory and Environment Research Laboratory) and OPISU (Provincial Agency for Social and Urban Integration)
- Real estate data retrieval.
- Knowledge graph creation
- Information Curating and improvement
 - Instance matching
 - Duplication
 - Augmentation
- GIS representation



Cognitive Digital Twins

- Digital twins are Digital replica of any physical object which captures
 - Attributes
 - Behaviour
 - Data connection
- CDT: An extension of Digital Twins with more capabilities related to analysis, communication and intelligence:
 - Information access
 - Analytic layer.
 - Cognitive layer



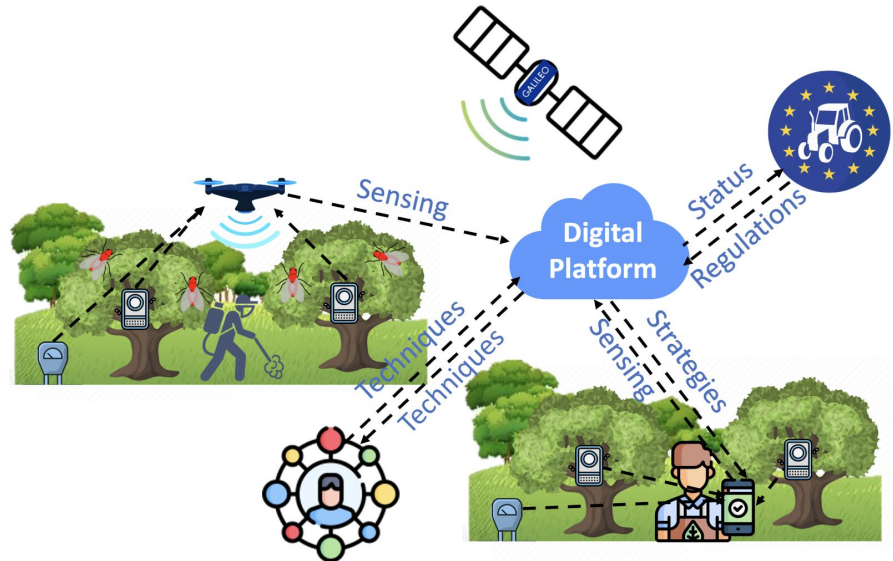
- Cognition
 - Perception
 - Attention
 - Memory
 - Working
 - Episodes
 - Semántic
 - Reasoning
 - Problems solution problemas
 - Learning
 - Life cycle management
 - Autonomy
 - Evolution
 - From data
 - Interaction with others CDT
 - Other lyfe cycle phases

AGRARIAN - Ai-based diaGnostic and contRoI optimisAtion foR multiple pLANTs

- AGRARIAN (Horizon 2024)
- Global plant health, vital to agriculture, forestry, and biodiversity, is threatened by injurious species exacerbated by globalisation, trade, and climate change..
- Goals:
 - Understand pest dynamics.
 - Develop effective control and detection strategies.
 - Extend the range of tools and technologies for pest prevention.
 - Analyse the social, economic and environmental implications.

Research areas: Computer science, agronomy, biology, and laws.

- Quarantine plant pests.
- Pilots in EU , Colombia and Argentina



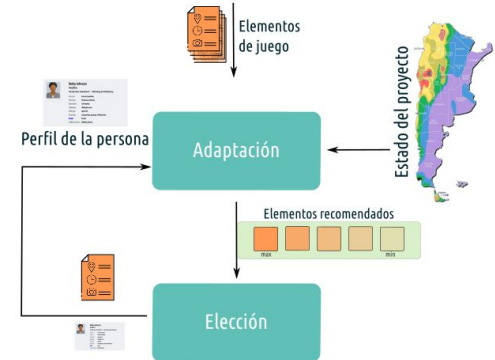
Collaborative Knowledge Building

Collective Collection of Geopositioned Data

- Agora - Tool for the construction of collection protocols
- Web tool for editing protocols.
- The smartphone as a collection tool.



- Adaptive Recommendation
- Travelling behaviour detection
- Adaptive recommendation according to
 - User profile.
 - Dynamic activity of each user..
 - Project goals



Remote Sensing: Water Pipe Leak Detection

- 10% — 40% of drinking water is lost due to main pipe leaks.
 - Severe
 - Superficial
 - Underground
- Veng
 - SAOCOM's images and products¹
 - Feasibility Study to detect leaks
 - Technology Evaluation (6 months)
 - Remote Sensing
 - C Band: Sentinel
 - L Band: SAOCOM
 - Competitors
 - Existing providers
 - Blocking Patents



Severe



Superficial



Underground

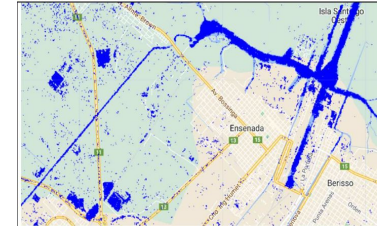
Remote Sensing: Water Pipe Leak Detection

- Technical Team

- Dr. Frery (Victoria University of Wellington, New Zealand)
- Dr. Delrioux (Universidad Nacional del Sur, Argentina) +
 - +1 PhD Student
- Dr Urbieta (Universidad Nacional de La Plata, Argentina)
 - + 1 Astronomer + 2 Research Assistants

- Deliverables

- Evaluation: textures, statistical and parametric for different leaks.
- Proposed Technique based on Multiband Statistical Analysis (L Band) ¹
- Experiment settings that represent different scenarios



Thanks!

Oil & Gas Personnel Hazards*

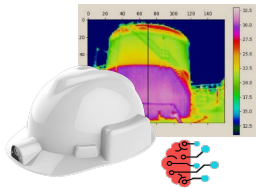
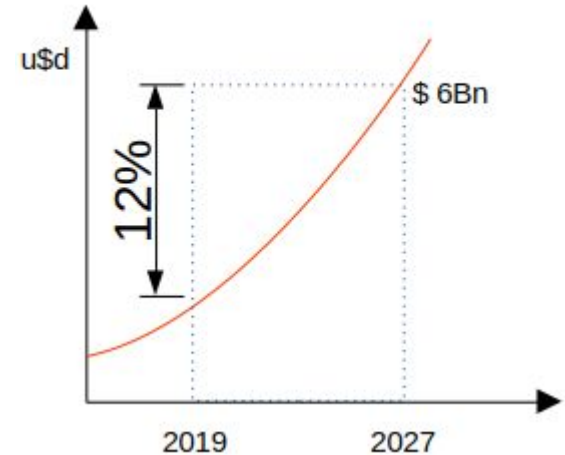
- Vehicle Collisions
- Struck-By/ Caught-In/ Caught-Between
- Explosions and Fires
- Falls
- Confined Spaces (hazardous gases)
- Ergonomic Hazards
- High Pressure Lines and Equipment
- Electrical and Other Hazardous Energy
- Machine Hazards

<https://www.osha.gov/oil-and-gas-extraction/hazards>

Oil & Gas Wearable Technologies

- Struck-By/ Caught-In/ Caught-Between
- Explosions and Fires
- Falls
- Confined Spaces (hazardous gases)

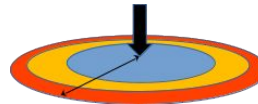
Oil&Gas Wearable Market



Optical & FLIR



Sensors & Comm



Locations & Proximity



Haptic Feedback

Oil & Gas Wearable: Research & Development

Research & Development

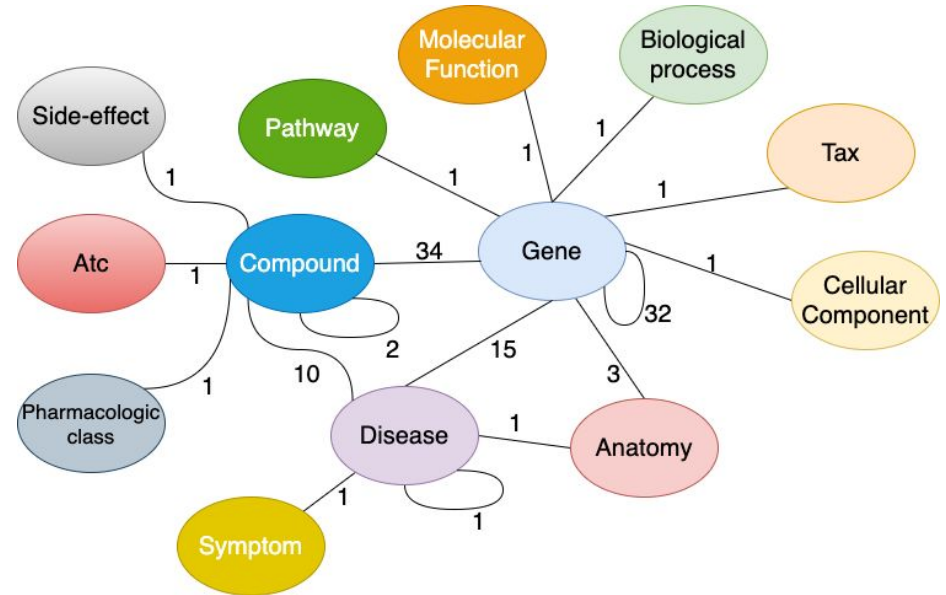
- Fuzzy Systems
 - Mobile Sensor Grid
 - Models for Heterogeneous Datasets
 - Data flow Analysis
- Wearable Technologies
 - Evaluation of Feedback (devices and uses)
 - Domain based Integration
 - Fault Tolerance
- UX
 - Usability
 - Adoption

Value to Market

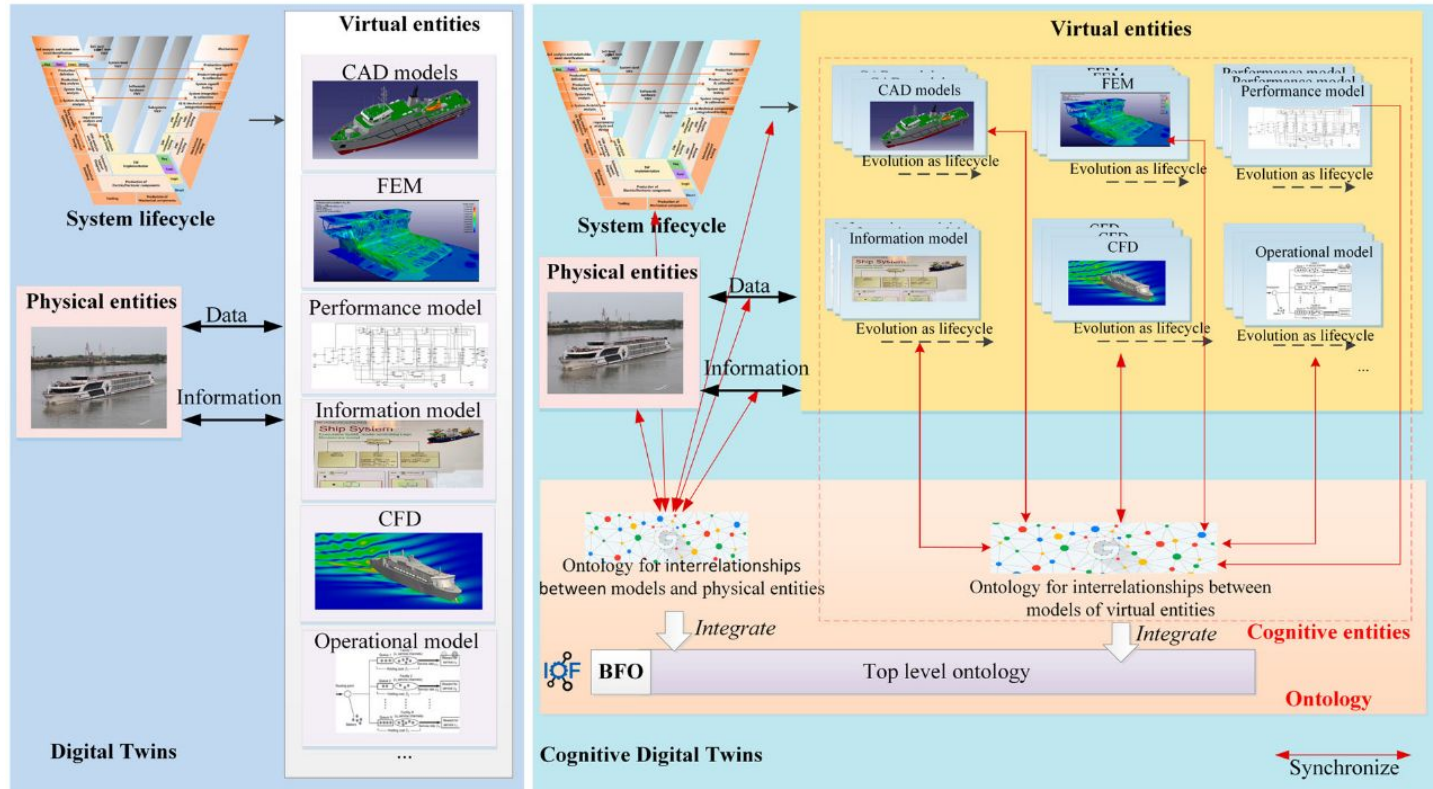
- Data & Workflow
 - Actionable Information
 - Process Analysis
- Risky Conditions / Accidents
 - Early Detection
 - Fast Response
 - Accountabilities
- Management
 - Equipment availability
 - Personnel location

Knowledge discovering with Knowledge Graphs

- A partir de múltiples grafos de conocimiento se aplican diferentes técnicas para descubrir conocimiento.
- Ejemplo: Drug Repurposing Knowledge Graph (DRKG)
- Experiencias de investigación en
 - DRKG - Enfermedades de transmisión de vectores.
 - Analisis de requerimientos en etapas tempranas.
 - Observatorio Inmobiliario



Digital Twin vs Cognitive Digital Twin



Identificación de propiedades biológicas en organismos utilizando técnicas de ML sobre secuencias de genoma.

Trabajo en conjunto con investigadores del Centro Nacional de Genómica y Bioinformática (CNGB) del ANLIS **Malbrán**.

Se realizó un software para investigadores que ayuda en el análisis de propiedades biológicas sobre miles de secuencias de genomas completos de un organismo mediante técnicas de Machine Learning,

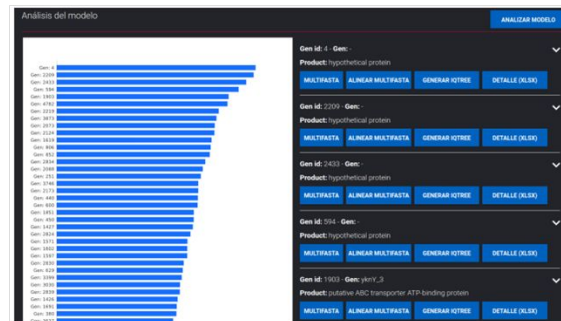
The screenshot shows a software interface with several sections:

- Estado:** A dropdown menu set to "LISTO PARA EVALUAR".
- Genomas en proyecto:** A text input field containing "1638".
- Tipo de estudio:** A dropdown menu set to "Aleatorio".
- Descripción:** A text input field containing "análisis para invasión de bacterias".
- Genomas etiquetados:** A text input field containing "1638".
- Arquitectura RNA:** A list of RNA architectures: "Capa 1: 8192 neuronas", "Capa 2: 12288 neuronas", "Capa 3: 12288 neuronas", "Capa 4: 10240 neuronas", "Capa 5: 4096 neuronas", "Capa 6: 512 neuronas", "Capa 7: 16 neuronas".
- Carpeta:** A dropdown menu set to "Invasividad".
- Etiquetados con SI / Etiquetados con NO:** Two text input fields, both containing "819".
- Genomas para evaluar:** A text input field containing "0".
- Evaluaciones:** A section with a "Nombre" field and a "Acciones" button.
- Footer:** "etp630ccuec-pyogenes_invasividad_2022-08-10_13:02:28he.csv" and "Filtros por página: 10 1-1 de 1".

Reduce la brecha entre las dos ciencias, al permitir analizar grandes volúmenes de información mediante una interfaz amigable a biólogos con poca experiencia en IA.

The screenshot shows the details for a specific gene:

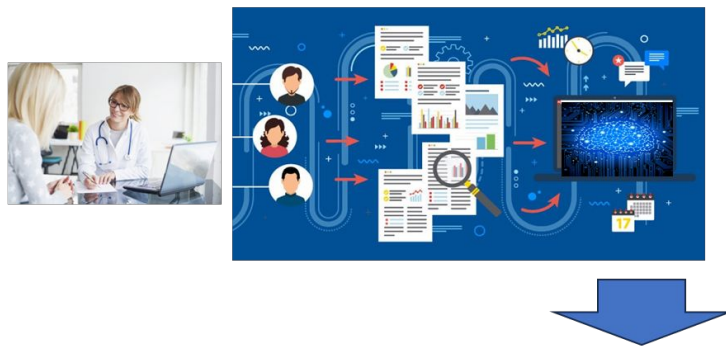
- Gen id:** 1903 - Gen: ykN_Y_3
- Product:** putative ABC transporter ATP-binding protein
- Presente en:** 540 genomas
- Presente en:** 321 genomas etiquetados con SI
- Presente en:** 219 genomas etiquetados con NO
- Translations:** A list of translations: "MLNLKDIRKSYHLGTEEFAILKGIDLEVNEDGDFLAIMGPSGSGKSTLMNIIGCLDKPGSGS", "YAIEGRDVSLSLSDNELADLRNQKIGFVFQNFNLMPKLTACQNVELPTVMNVPKERRK", "RALEMLKLVLGLEERSEFKPMELSGGQKQKQVIAIARALVTNPSFILGDEPTGALDTKTSVQI", "MDLFKQFNDNGKTIITHEPEVAALCKKTIVLRDGNIEHSDIE".



Generación de reglas explicativas para RNA

Las RNAs son poco transparentes, es decir, no está claro que información de los datos de entrada les hace llegar realmente a sus decisiones

Implementamos **algoritmos de explicabilidad** que generan reglas precisas y fácilmente interpretables



```
SI ((colesterol > 2.4 AND presión_arterial > 14
    AND glucosa > 1.20 AND edad > 50)
    OR (antecedentes_familiares AND sobrepeso AND tabaquismo ))
entonces riesgo_cardiaco = Verdadero
sino riesgo_cardiaco = Falso
```