Projects 2.4 and 4.1:
Big Data and Artificial Intelligence
New techniques of extraction, generation, and use of knowledge
and
Implications in society

First InPrInt Seminar

Partnership Building towards
Stronger Engagement in International Collaboration
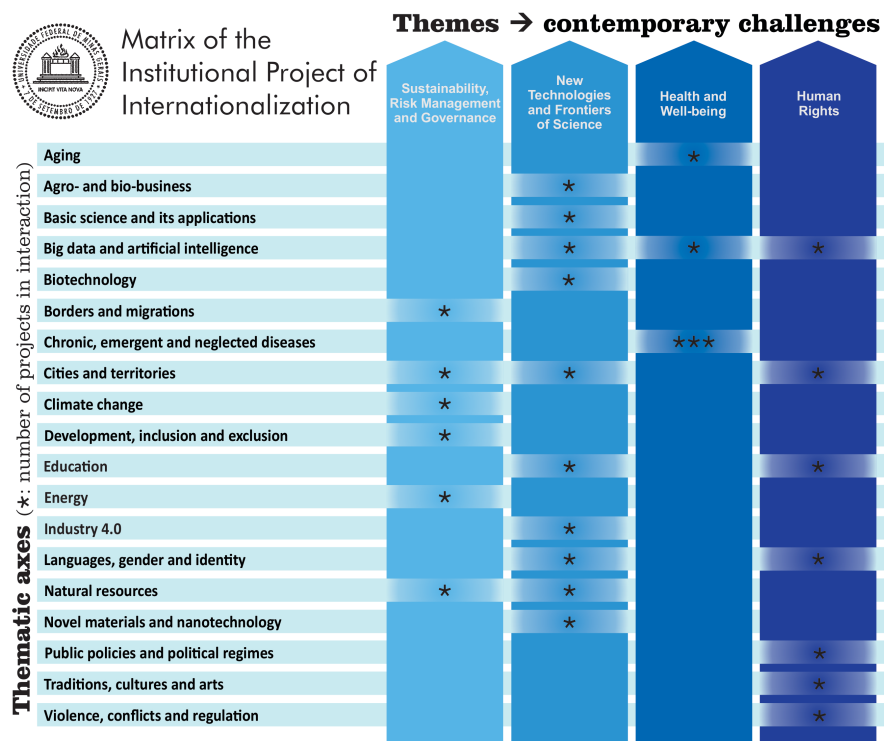
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How PrInt/UFMG changes the ways we collaborate

Matrix of the Institutional Project of Internationalization

Themes → contemporary challenges

- Actions building on a matrix of **four themes** (contemporary challenges) and 28 thematic axes (**projects**) aligned with the United Nations Sustainable Development Goals

- **PhD Programs** are expected to work together with **partner institutions** abroad to develop **cross-cutting research** aligned with the PrInt/UFMG themes and projects

- Funding will be allocated to outgoing and incoming mobility actions within the four themes by means of **internal calls**

Matrix of the Institutional Project of Internationalization

Themes → contemporary challenges

number of projects in interaction

	Sustainability, Risk Management and Governance	New Technologies and Frontiers of Science	Health and Well-being	Human Rights
Aging			*	
Agro- and bio-business		*		
Basic science and its applications		*		
Big data and artificial intelligence		*	*	*
Biotechnology		*		
Borders and migrations	*			
Chronic, emergent and neglected diseases			***	
Cities and territories	*	*		*
Climate change	*			
Development, inclusion and exclusion	*			
Education		*		*

PrInt/UFMG mobility goals

- To **foster and enhance collaboration** with partner universities worldwide by means of joint innovative research and capacity building of human resources

- To consolidate the training and experience abroad of **UFMG faculty members** with both a junior and a senior profile as visiting professors at partner universities

- To train **PhD students** abroad through internships at partner universities with a strong focus on cotutelle (double PhD degrees)

- To recruit **postdoctoral** fellows and early-career researchers with experience abroad to work at UFMG within the PrInt themes and projects

- To attract **internationally renowned visiting professors** with highly recognized experience for short stays (15 days) at UFMG

PrInt/UFMG mobility actions

OUTGOING

- PhD mobility grants for internships abroad (six to twelve months)
- Junior Professor grants for visiting professorships abroad (six months)
- Senior Professor grants for visiting professorships abroad (six months)

INCOMING

- Postdoctoral grants for activities at UFMG (12 months, renewable)
- Early-career researcher grants for activities at UFMG (12 months, renewable)
- Senior Professor grants for international visitors at UFMG (15 days)

What do we mean by "Big Data and Artificial Intelligence"?

- **Big data**: extremely large data sets that may be analyzed computationally and interpreted to reveal
    - patterns,
    - trends,
    - associations …

    - Some tasks involved:
        - Data generation / collection
        - Data preparation / management
        - Models building / processing with algorithms
        - Presentation / visualization

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What do we mean by "Big Data and Artificial Intelligence"?

- **Artificial intelligence**: the designing and building of intelligent agents that receive percepts from the environment and take actions that affect that environment.

  - This brings together distinct subfields of
    - computer vision,
    - speech processing,
    - natural language processing (and understanding),
    - reasoning,
    - knowledge representation,
    - learning,
    - robotics,
    with the aim of achieving an outcome by the machine

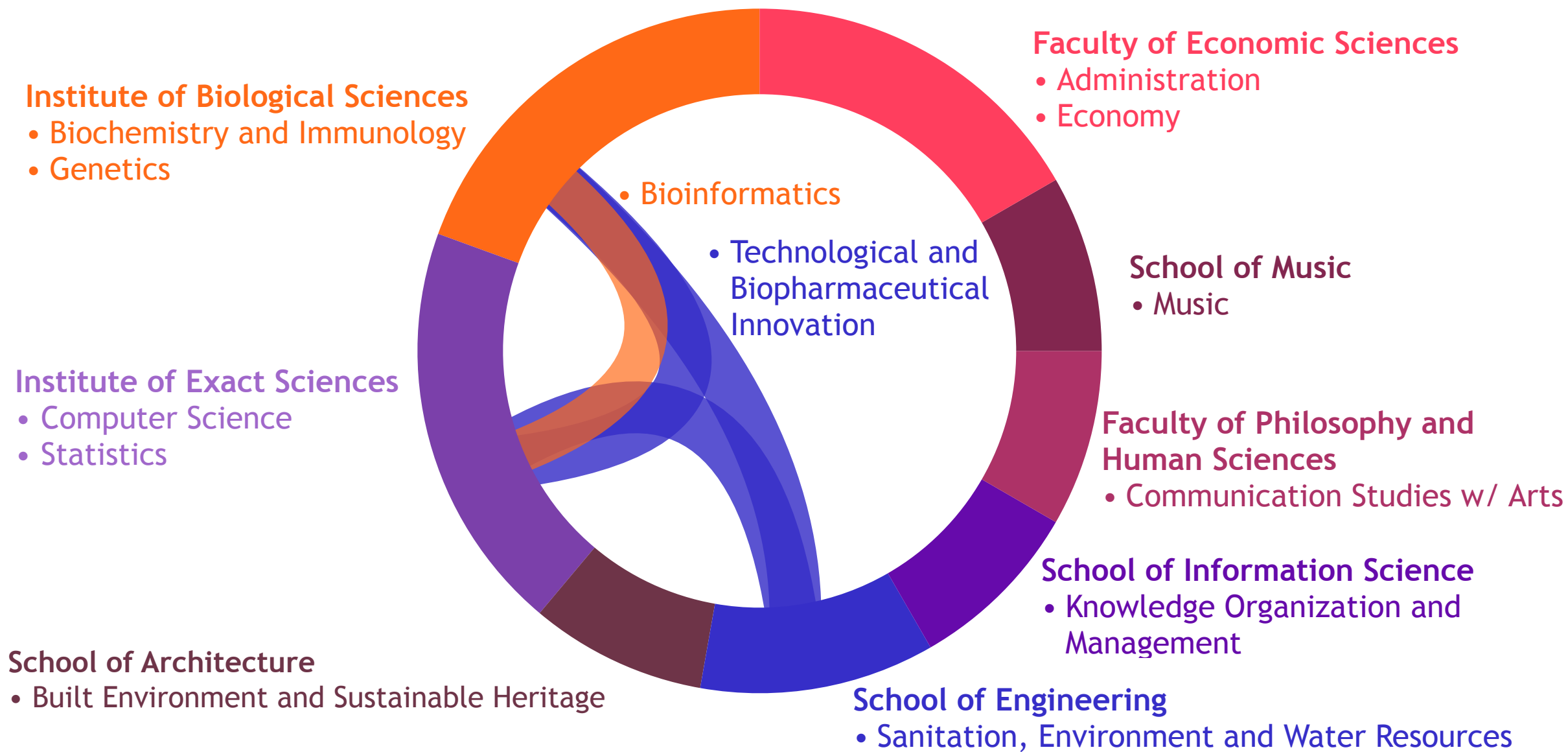 *—Stuart Russel and Peter Nerving*

Partner institutions willing to collaborate with UFMG (so far)

- **ZHAW Zurich University of Applied Sciences** *(10min presentation)*
- **University of Warwick** *(10min presentation)*
- **University of Technology Sidney** *(10min presentation)*
- **Vrije Universiteit** *(10min presentation)*
- **University of Southampton** *(10min presentation)*
- **University of Münster** *(10min presentation)*

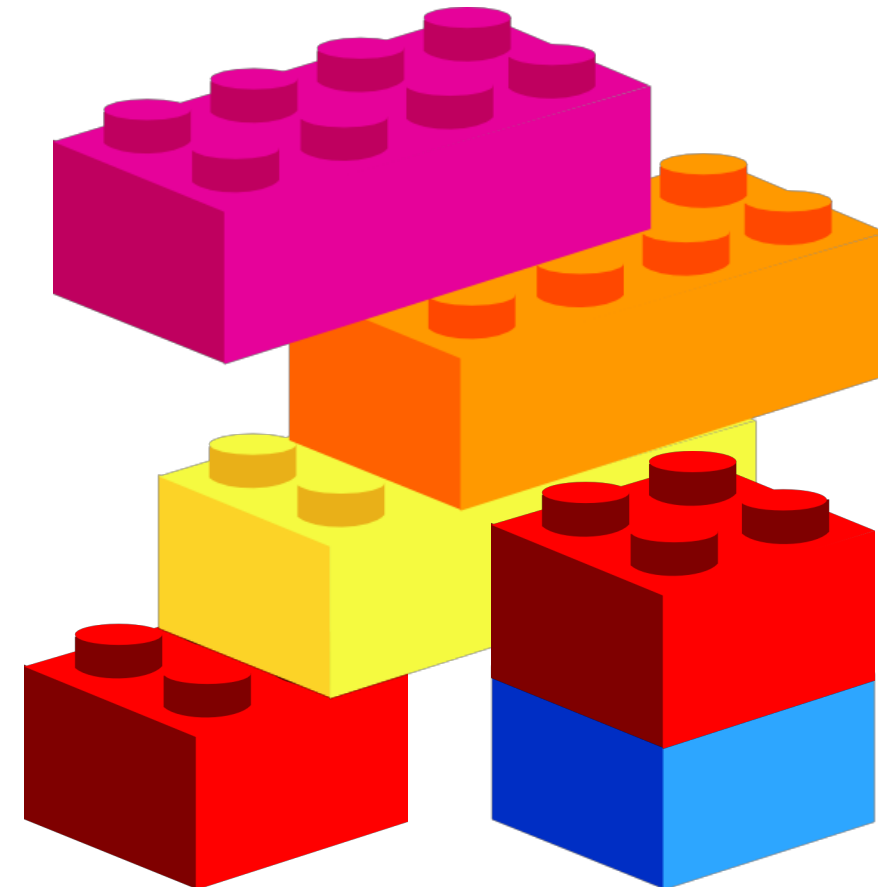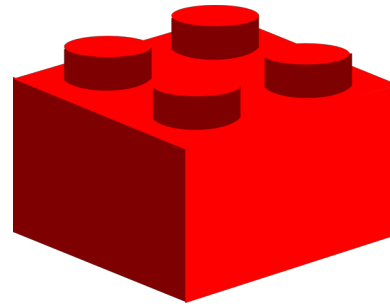- University of Alberta

New collaborations will be most welcome!
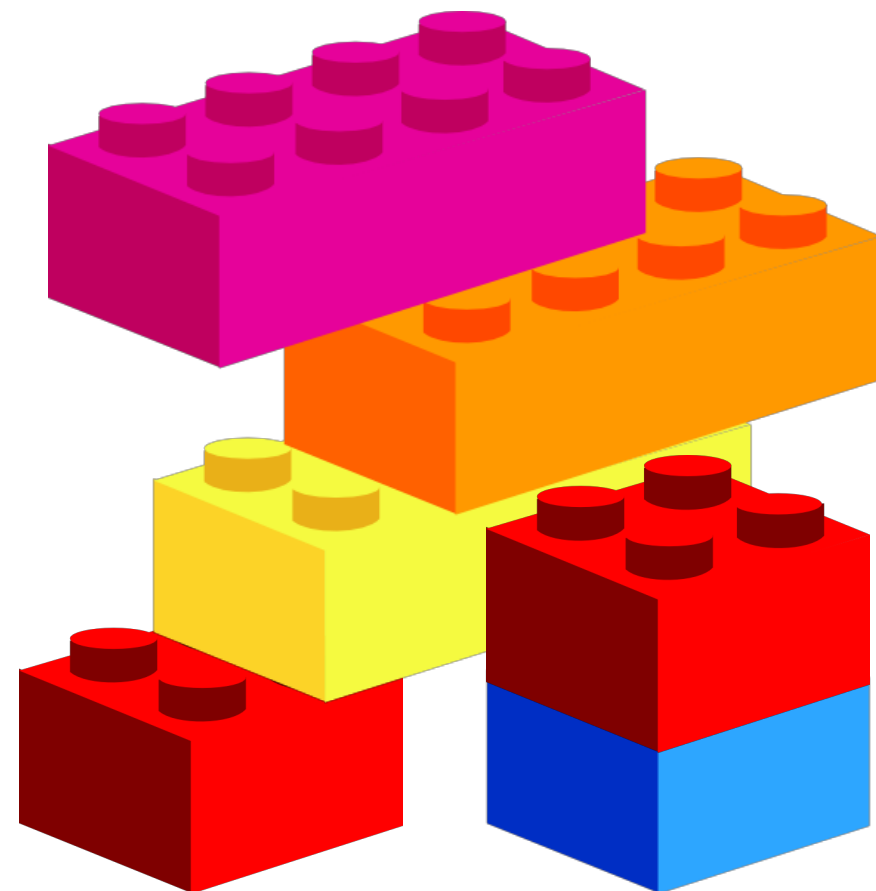
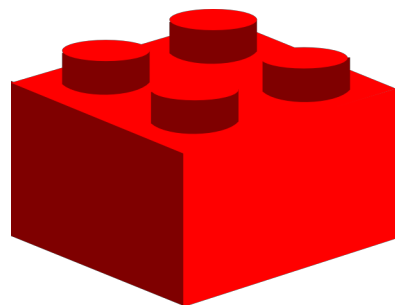# UFMG Graduate programs in the present projects

Institute of Biological Sciences
• Biochemistry and Immunology
• Genetics

Institute of Exact Sciences
• Computer Science
• Statistics

School of Architecture
• Built Environment and Sustainable Heritage

• Bioinformatics

• Technological and Biopharmaceutical Innovation

Faculty of Economic Sciences
• Administration
• Economy

School of Music
• Music

Faculty of Philosophy and Human Sciences
• Communication Studies w/ Arts

School of Information Science
• Knowledge Organization and Management

School of Engineering
• Sanitation, Environment and Water Resources

UFMG Contacts

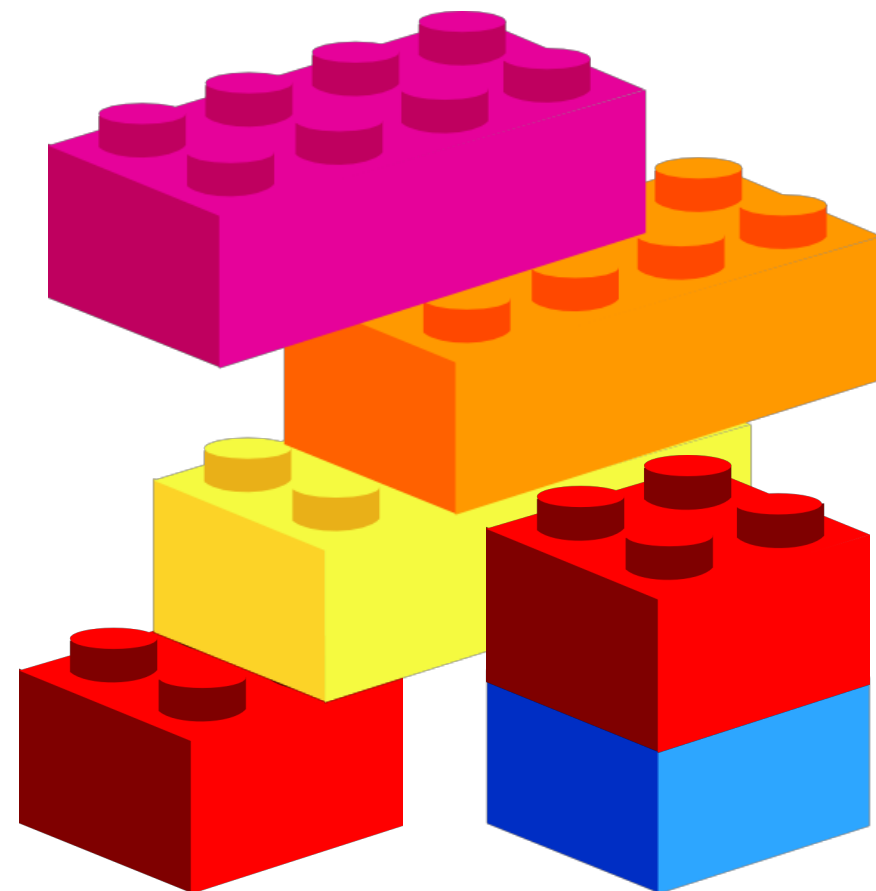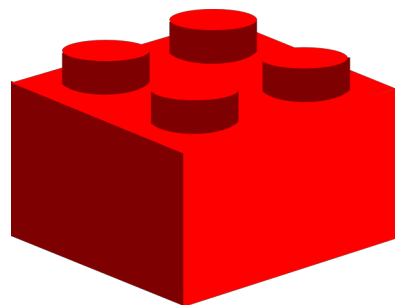| Professor	Graduate Program	E-mail
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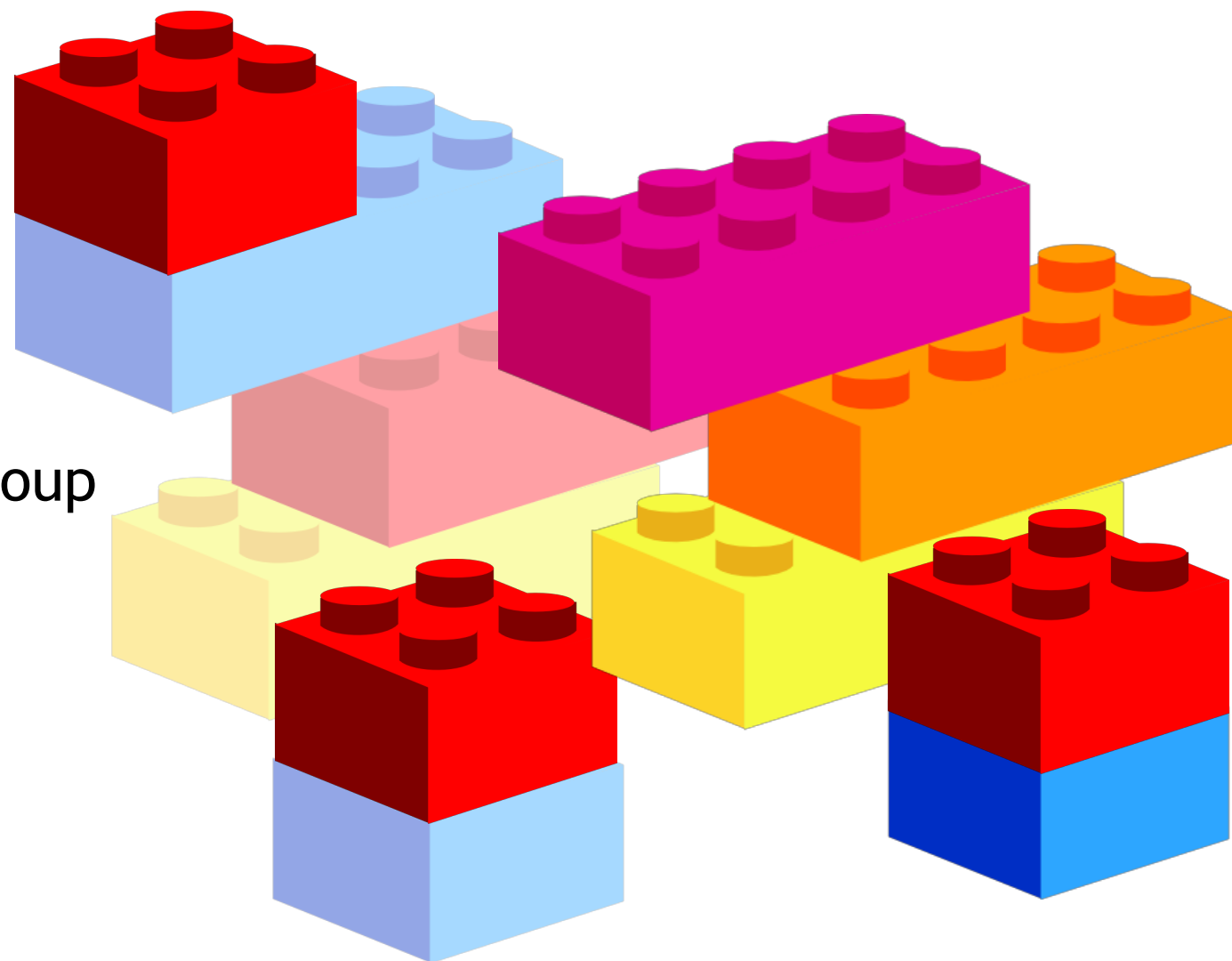- Project has a diversified set of building bricks or **competencies**

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- What complementary competencies can foreign partner institutions bring?

Models, algorithms, methods, tools

Problems and applications

Existing competencies and expertise

Institute of Exact Sciences and School of Information Science

Big data

- Data management
  - Modeling and representation of semi-structured data
  - Queries processing
  - Data extraction
  - Semantic web
  - Data integration
- Knowledge organization and management
- Data warehouses
- Geographic databases
- Data visualization
- Information retrieval
- Recommendation systems
- Complex networks
- Social computing

Intelligent Systems

- Statistics for data science
- Probabilistic graphic models
- Data Mining
- Machine learning
- Natural computing
- Natural language processing
- Computational vision
- Visual computing
- Digital image processing
- Digital processing of sound and video
- Robotics and mobile robotics
- Game theory
- Financial computing and quantitative finance

Existing competencies and expertise

Faculty of Economic Sciences

- Management theories
- Marketing analytics
- Applied marketing models
- Business models and simulation

School of Information Science

- Biomedical vocabularies
- Legal vocabularies

Institute of Biological Sciences

- Genomic and metagenomic
- Population genetic
- Proteomic
- Transcriptomic
- Interatomic
- Systems biology

Faculty of Philosophy and Human Sciences

- Critical study of social media and their implications in society

School of Architecture

- Smart city
- Building information model
- Information architecture
- Knowledge organization systems
- Management of organizational information and knowledge

Research issues and questions

Big data

- Volume: amount of data
- Velocity: speed of data generation
- Variety: type, nature and format of data
- Veracity: trustworthiness
- Value: insights and impact

Artificial intelligence

- Lack of computing power
- High expectations
- Generalized AI
- Lack of people power
- Human interface
- Building trust

Impacts

- Together, big data and intelligent systems challenges are amplified bringing great opportunities of research development and innovation
  - These challenges applies to several application domains

Goals

Short-term goals:
- Increase the group of people researching in the topic locally
- Initiate international collaboration
- Promote the mobility of researchers

Medium-term goals:
- Improve the expertise of faculty members and students
- Expand and consolidate started collaborations
- Promote events, debates and other scientific communication initiatives

Long-term goals:
- Improve the quality of research production
- Stimulate the formation of international collaboration networks

Some existing funding lines

- CAPES (COFECUB, FCT, PVE)
- CNPq
- FAPEMIG

- CEMIG

- EUBRA - BIGSEA - Europe Brazil Collaboration of Big Data Scientific Research through Cloud-Centric Applications (Computer Science)
  - Coordinated Call jointly funded by the EU and Brazil, which focused on Advanced Cyber Infrastructures
- Tetherless World Constellation - Rensselaer Polytechnic Institute

Concluding remarks

- New **problems** and a **growing volume** of available data demand new **models** and **algorithms** (what is related to data science)

- Scenario of **diversity** of **problems** and **fields** related to the present projects

- Perspective of results of high impact and value to society

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