Mathematical Logics
Description Logic: Introduction

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1. Intuition: the logic of Knowledge Graphs
2. Examples of Knowledge Graphs
3. Two levels in knowledge graphs
4. Description logics
5. The architecture of a DL reasoning system

Description Logics and Knowledge graphs

Description Logics(DL) is (can be seen as) a

- family of logics that allow to speak about
- a domain composed of a set of **objects**,
- organized in **concepts** (**classes)**,
- and related one another via **binary relations**.

Description logics allows to predicate about labeled directed graphs (also called **Knowledge Graphs** (**KGs**))

- vertexes represents (classes of) real world objects
- edges represents properties between (pairs of) objects

An example of Knowledge graph
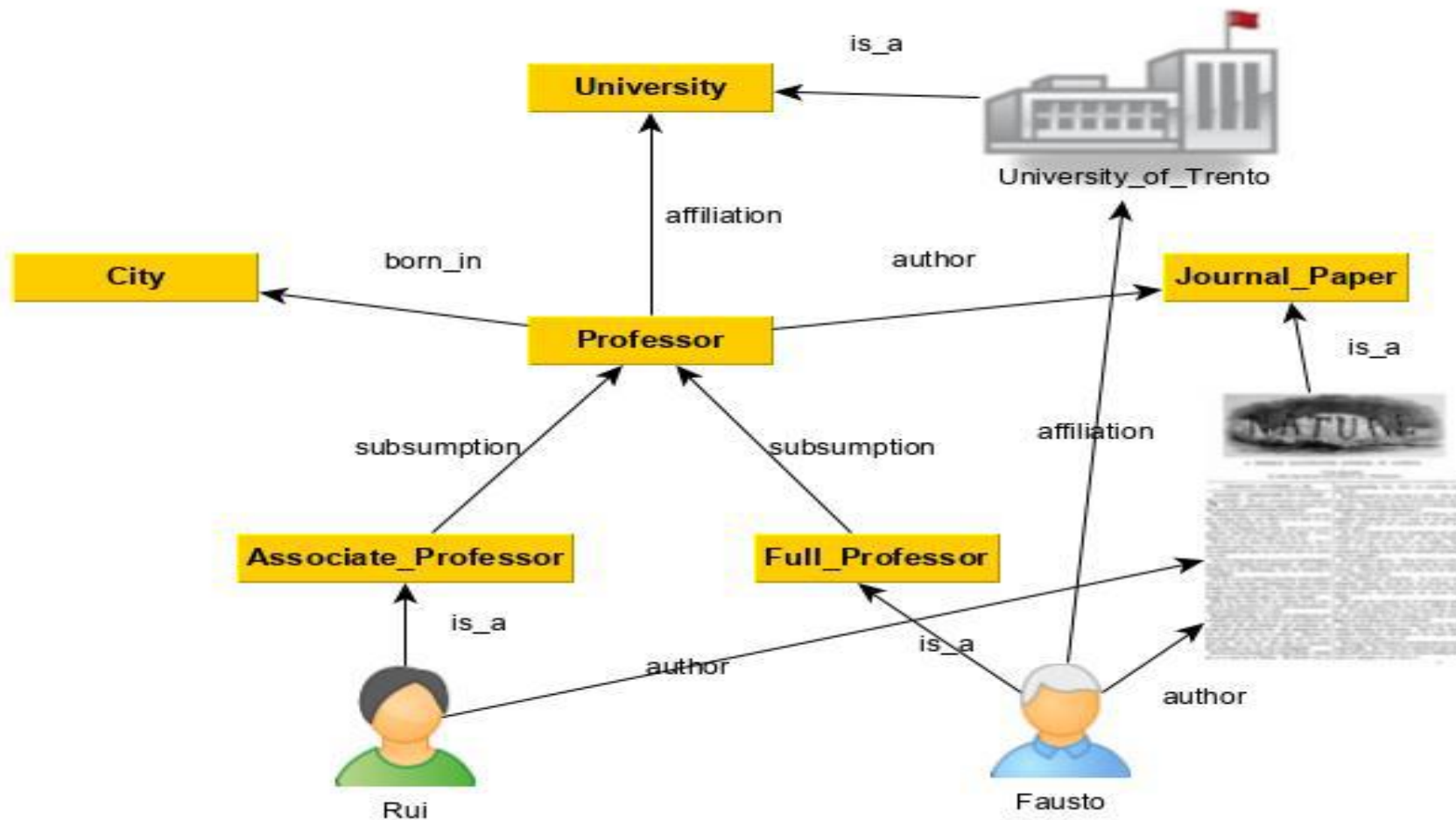
NOTE I: Every portion of the world can be abstractly represented as a **KG (set theory)**

NOTE II: relational databases and **ER Models** are (also) special kinds of **KGs** since they are (different) representations of objects and properties

Properties of KGs

- *NO fixed Knowledge graph schema* – The schema can evolve (add types of objects and relations) - Very good when schema not known at design time and/ or it is known to evolve while in production

- *NO requirement to know all data values for all objects* – not all graph links need to exist - Very good for sparse data (namely situations where all values of objects are not needed)

Relational Databases: optimal for applications where everything is known at design time (e.g., enterprise applications). They can be seen as saturated/ statica knowledge graphs (see last section)

Knowledge graphs: optimal for applications where situation evolves while system in production or where data are not in control (e.g., data integration, web applications

KG - example

Exercise

Informally represent Metro lines in Milan in a KG: 10 objects, 30 properties (linea, stazione metro, stazione ferroviaria, quartiere, città, …)
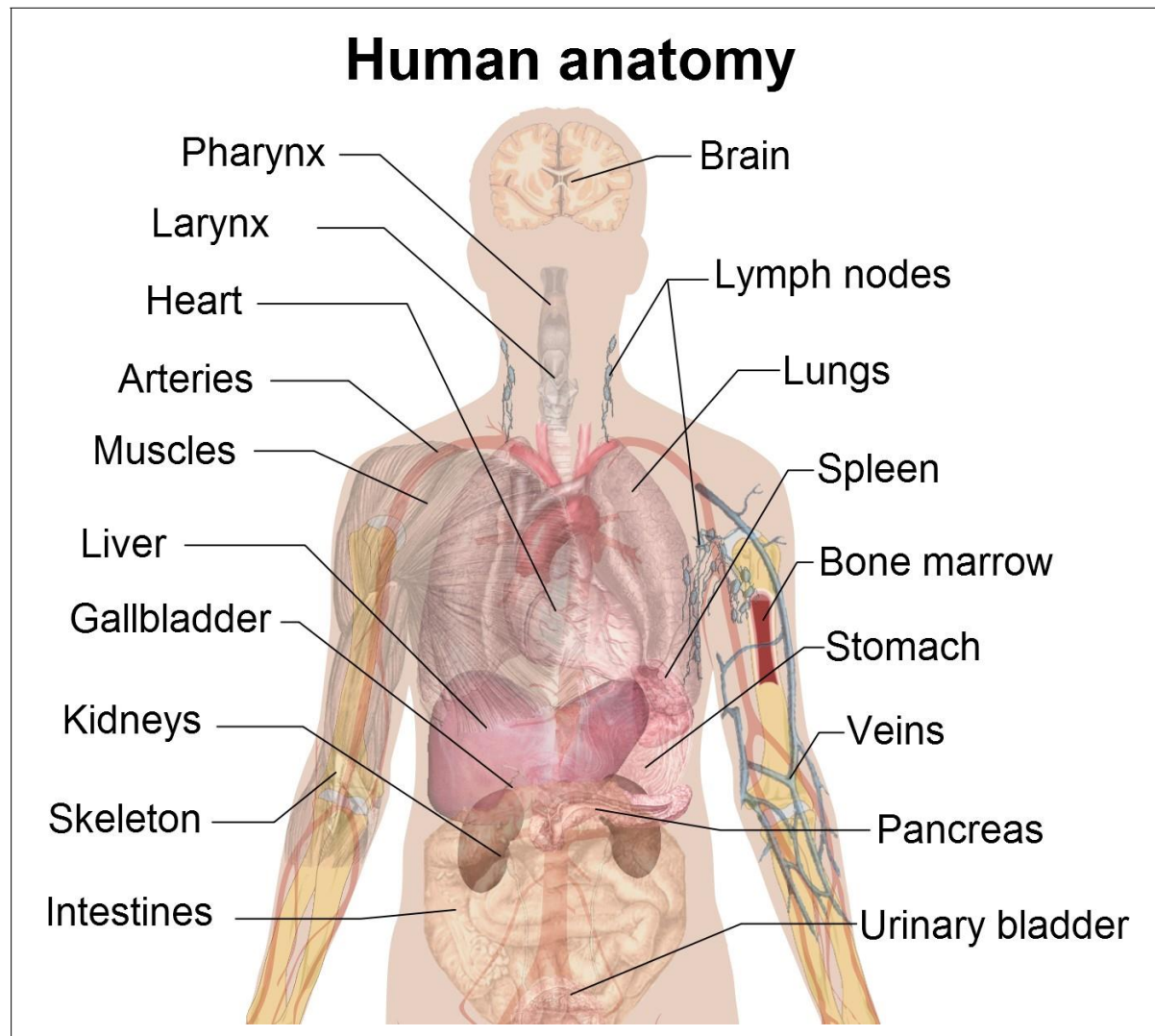
Exercise

Informally represent some aspects of Facebook as a KG : 10 objects, 30 properties (person, amico, foto, post, località, evento, …)

Human anatomy

Exercise

Informally represent some aspects of human anatomy as a KG : 10 objects, 30 properties (parte del corpo, funzione, attività, organi azione, organi percezione, ….)

Exercise

Informally represent some aspects of everyday life as a KG : 10 objects, 30 properties

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