МИНОБРНАУКИ РОССИИ
Федеральное государственное автономное образовательное учреждение
высшего образования
«ЮЖНЫЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ»
ИНСТИТУТ КОМПЬЮТЕРНЫХ ТЕХНОЛОГИЙ И ИНФОРМАЦИОННОЙ
БЕЗОПАСНОСТИ

Knowledge Graph

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Glossary

Types of entities and relations are defined in some machine-understandable dictionaries called **ontologies**.

The standard ontology language is called OWL **(Web Ontology Language).**

Knowledge Graphs are large networks of entities, their semantic types, properties, and relationships between those entities.

In a knowledge graph, the objects are called **“nodes”,** while relationships are called **“edges”.**

Technology in Brief

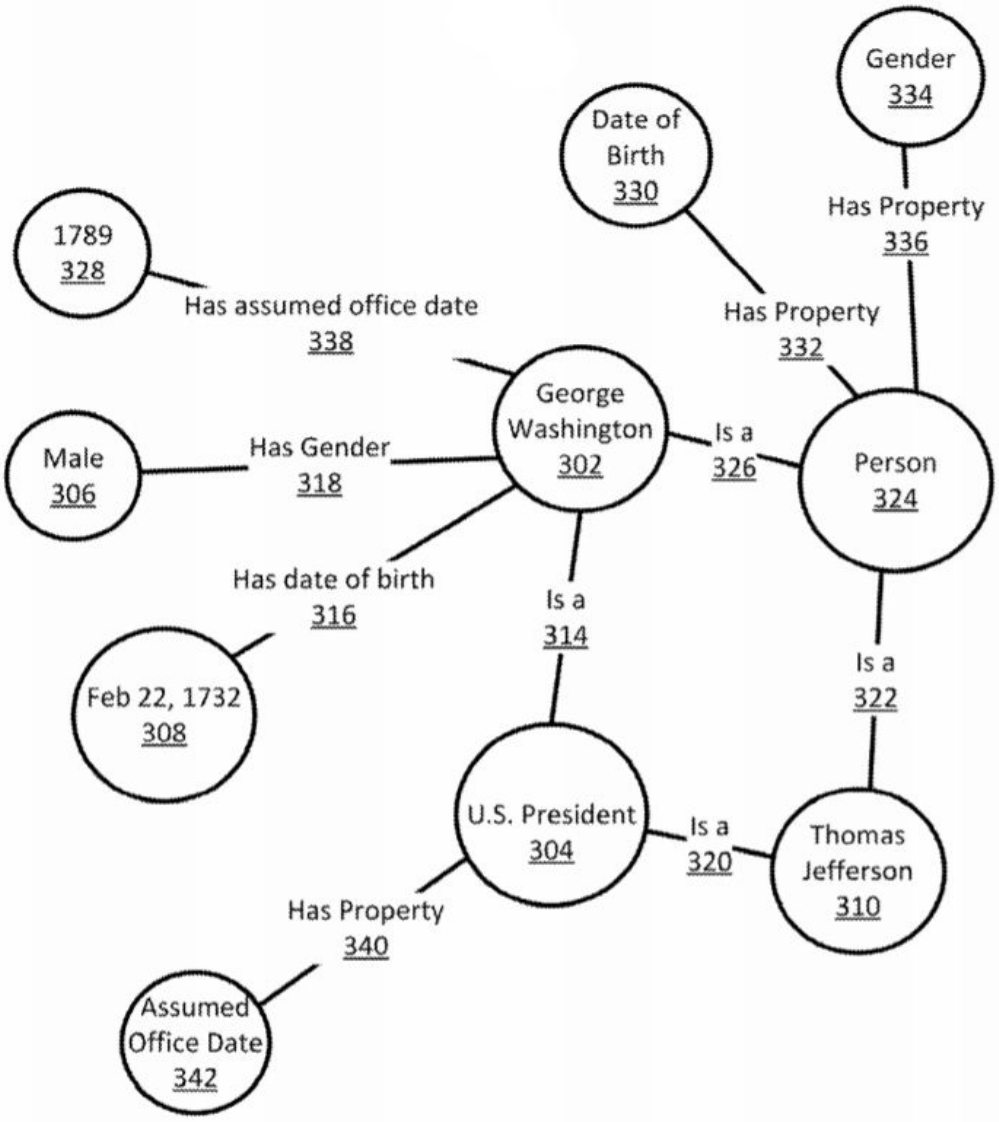
A **knowledge graph** consists of a set of interconnected typed entities and their attributes.

Knowledge Graphs are large networks of ***entities***, their ***semantic types***, ***properties***, and ***relationships*** between those entities.

Those ***entities*** can be grouped into ***classes*** according to their ***semantics***, and should ideally cover every aspect that is important for a certain domain

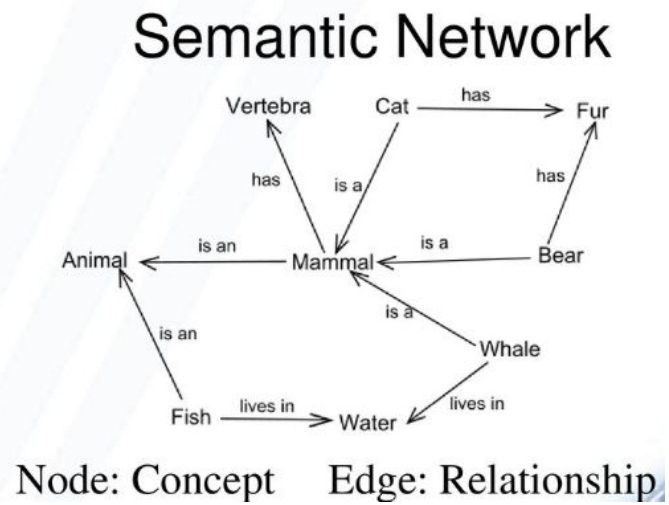
A visualization of the Knowledge Graph

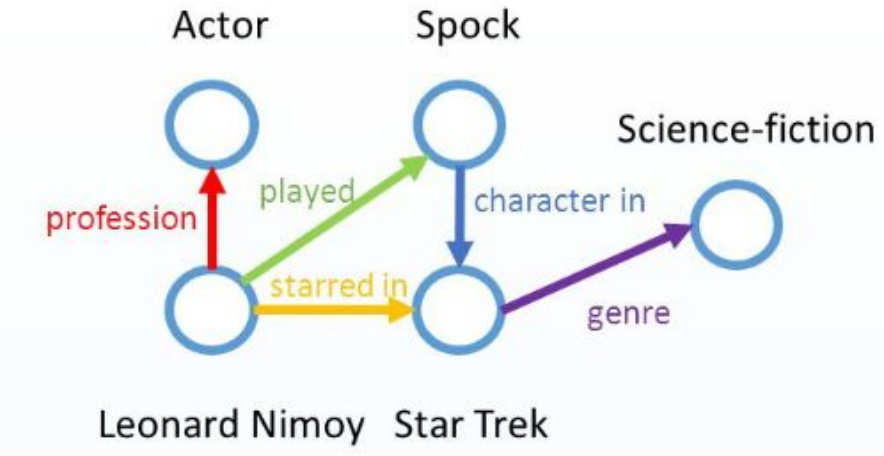
Technology in Brief



Technology in Brief

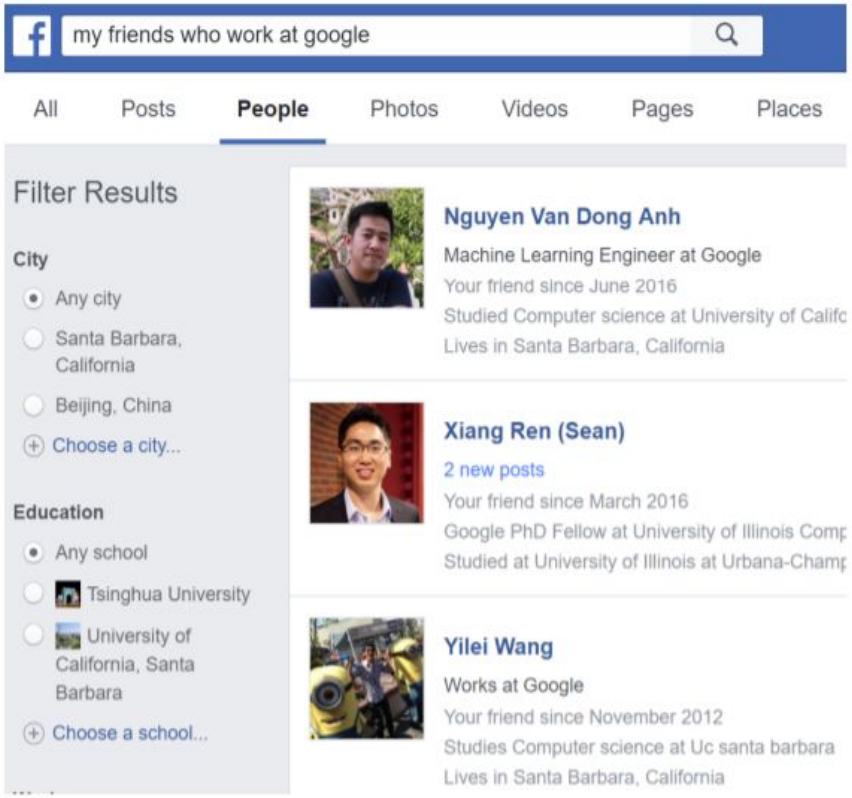
a.k.a.	Semantic network	(1960s)
a.k.a.	Knowledge base	(1970s)
a.k.a.	Semantic web	(2000s)
a.k.a.	Big data	(2010s)
a.k.a.	Knowledge graph	(2012)
a.k.a.	Artificial Intelligence	





Technology in Brief

Application: Facebook Entity Graph



People, Places, and Things

Facebook's knowledge graph (entity graph) stores as entities the users, places, pages and other objects within the Facebook.

Connecting

The connections between the entities indicate the type of relationship between them, such as friend, following, photo, check-in, etc.

Methodology

A **knowledge graph**

1. mainly describes real world entities and their interrelations, organized in a graph.

2. defines possible classes and relations of entities in a schema.

3. allows for potentially interrelating arbitrary entities with each other.

4. covers various topical domains.

Methodology

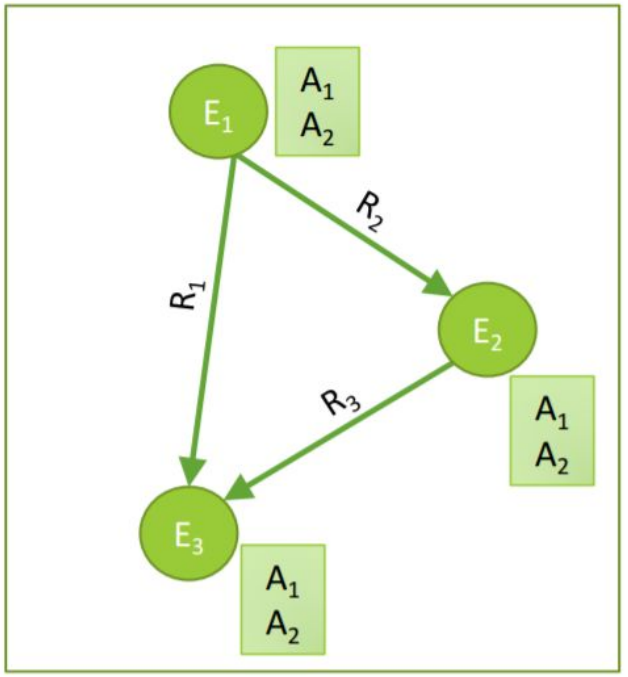
There are various ways of building such knowledge graphs. They can be curated like **Cyc**, edited by the crowd like **Freebase** and **Wikidata**, or extracted from large-scale, semi-structured web knowledge bases such as **Wikipedia**, like **DBpedia** and **YAGO** . Furthermore, information extraction methods for unstructured or semi-structured information are proposed, which lead to knowledge graphs like **NELL**, **PROSPERA**, or **KnowledgeVault**.

State of the Art and Open Issues

Whichever approach is taken for constructing a knowledge graph, the result will never be perfect.

Basic problems

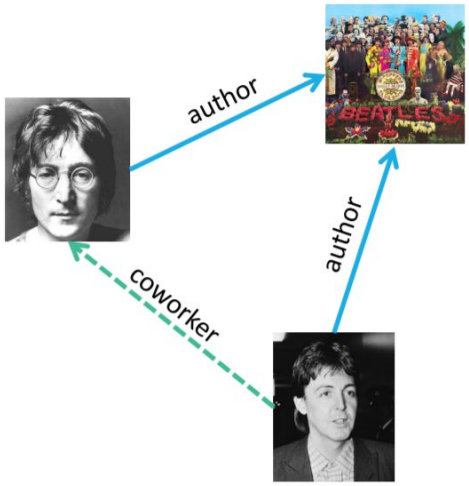
- **Who** are the entities (nodes) in the graph?
- **What** are their attributes and types (labels)?
- **How** are they related (edges)?

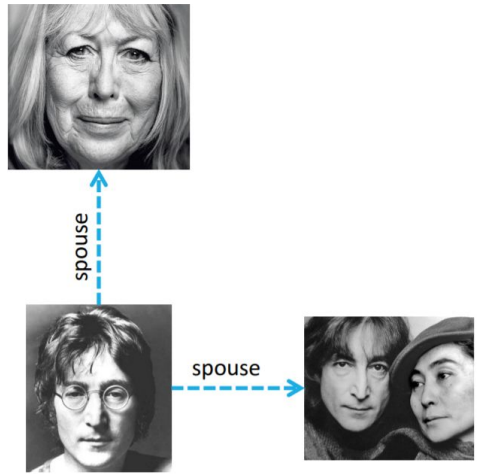


State of the Art and Open Issues

Extracted knowledge is:

- ambiguous:
  - Ex: Beetles, beetles, Beatle
  - Ex: citizenOf, livedIn, bornI
- incomplete
  - Ex: missing relationship
  - Ex: missing labels
  - Ex: missing entities
- inconsistent
  - Ex: Cynthia Lennon, Yoko Ono
  - Ex: exclusive labels (alive, dead)
  - Ex: domain-range constraints





State of the Art and Open Issues

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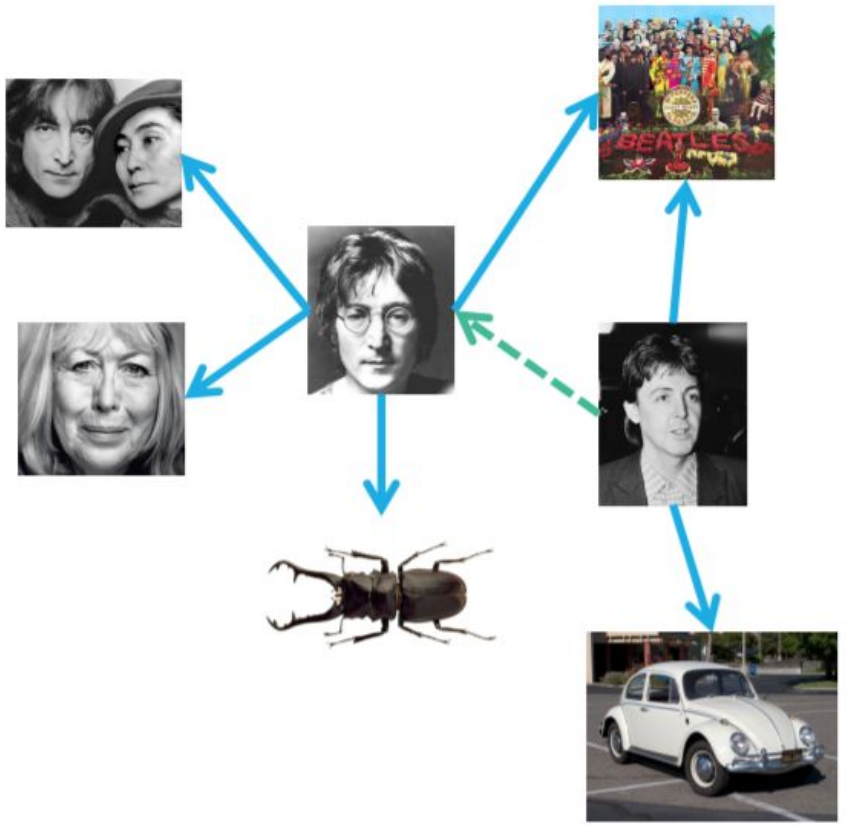
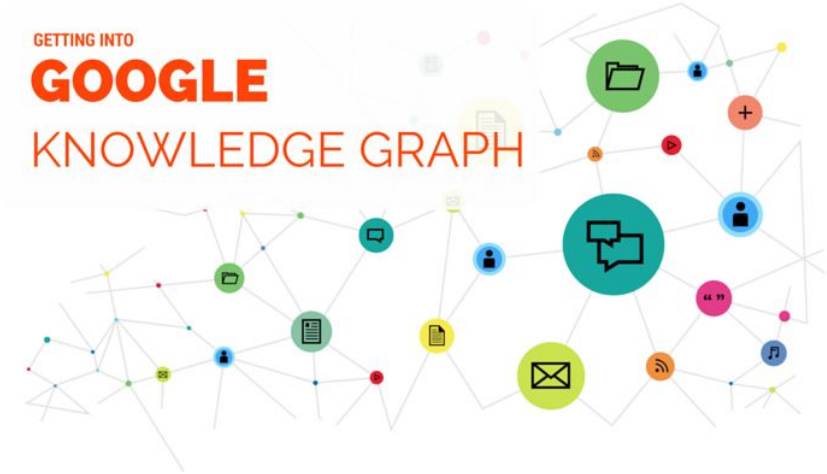
- incomplete
- inconsistent



Industry Leaders, Startup

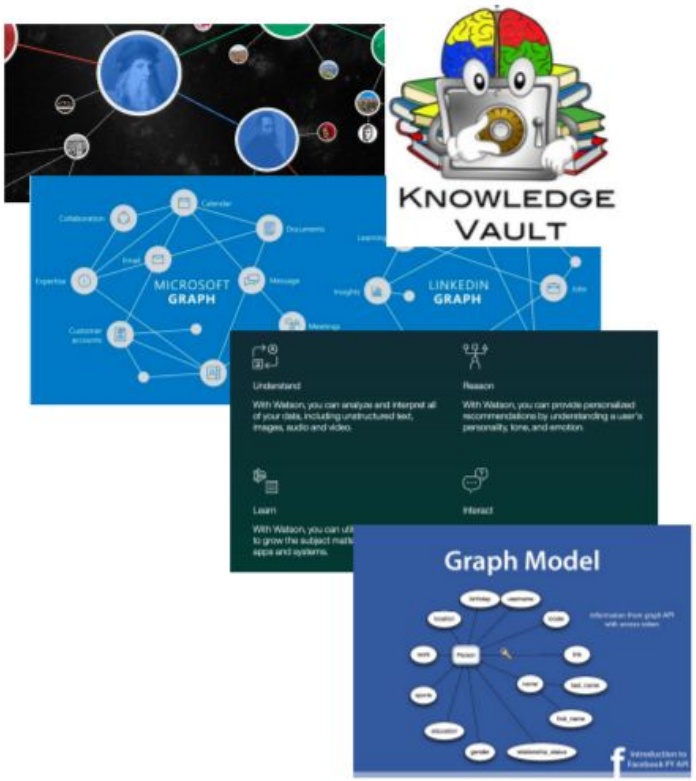
The term **'Knowledge Graph'** became well known in 2012 when **Google** started to use knowledge graph in their search engine, allowing users to search for things, people or places, rather than just matching strings in the search queries with those in Web documents.

Inspired by the success story **of Google**, knowledge graphs are gaining momentum in the world's leading information companies.



Industry Leaders, Startup

- Google Knowledge Graph
  - Google Knowledge Vault
- Amazon Product Graph
- Facebook Graph API
- IBM Watson
- Microsoft Satori
  - Project Hanover/Literome
- LinkedIn Knowledge Graph
- Yandex Object Answer
- Diffbot, GraphIQ, Maana, ParseHub, Reactor Labs, SpazioDati



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