Technology Overview about Artificial Intelligence for Clinical Data Science

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Short History about AI

The field of AI research was born at a workshop at Dartmouth College in 1956. Attendees Allen Newell (CMU), Herbert Simon (CMU), John McCarthy (MIT), Marvin Minsky (MIT) and Arthur Samuel (IBM) became the founders and leaders of AI research.

In the early 1980s, AI research was revived by the commercial success of expert systems,[37] a form of AI program that simulated the knowledge and analytical skills of human experts. By 1985 the market for AI had reached over a billion dollars.

In 2011, a Jeopardy! quiz show exhibition match, IBM's question answering system, Watson, defeated the two greatest Jeopardy! champions, Brad Rutter and Ken Jennings, by a significant margin.

From wikipedia (https://en.wikipedia.org/wiki/Artificial_intelligence)

Google's DeepMind Technologies developed a system capable of learning how to play Atari video games using only pixels as data input. In 2015 they demonstrated their AlphaGo system, which learned the game of Go well enough to beat a professional Go player.[183][184][185] Google Translate uses an LSTM to translate between more than 100 languages.

From wikipedia (https://en.wikipedia.org/wiki/Deep_learning)

What is the AI?

平成 28 年版 情報通信白書 より

研究者	所属	定義
中島秀之	公立はこだて未来大学	人工的につくられた、知能を持つ実態。あるいはそれをつくろうとすることによって知能自体を研究する分野である
武田英明	国立情報学研究所	
西田豊明	京都大学	「知能を持つメカ」ないしは「心を持つメカ」である
溝口理一郎	北陸先端科学技術大学院	人工的につくった知的な振る舞いをするためのもの（システム）である
長尾真	京都大学	人間の頭脳活動を極限までシミュレートするシステムである
堀浩一	東京大学	人工的に作る新しい知能の世界である
浅田稔	大阪大学	知能の定義が明確でないので、人工知能を明確に定義できない
松原仁	公立はこだて未来大学	究極には人間と区別が付かない人工的な知能のこと
池上高志	東京大学	自然にわれわれがペットや人に接触するような、情動と冗談に満ちた相互作用を、物理法則に関係なく、あるいは逆らって、人工的につくり出せるシステム
山口高平	慶應義塾大学	人の知的な振る舞いを模倣・支援・超越するための構成的システム
栗原聡	電気通信大学	人工的につくられる知能であるが、その知能のレベルは人を超えているものを想像している
山川宏	ドワンゴ人工知能研究所	計算機知能のうちで、人間が直接・間接に設計する場合を人工知能と呼んで良いのではないかと思う
松尾豊	東京大学	人工的につくられた人間のような知能、ないしはそれをつくる技術。人間のように知的であるとは、「気づくことのできる」コンピュータ、つまり、データの中から特徴量を生成し現象をモデル化することのできるコンピュータという意味である

（出典）松尾豊「人工知能は人間を超えるか」（KADOKAWA）p.45より作成

My position to the AI

AI is a complex entity built of the following components that is able to communicate with human using human natural language.

The Key Components of AI

1) Knowledge Base
2) Machine Learning
3) Natural Language Processing

New terms instead of AI

Robotic Process Automation (RPA)

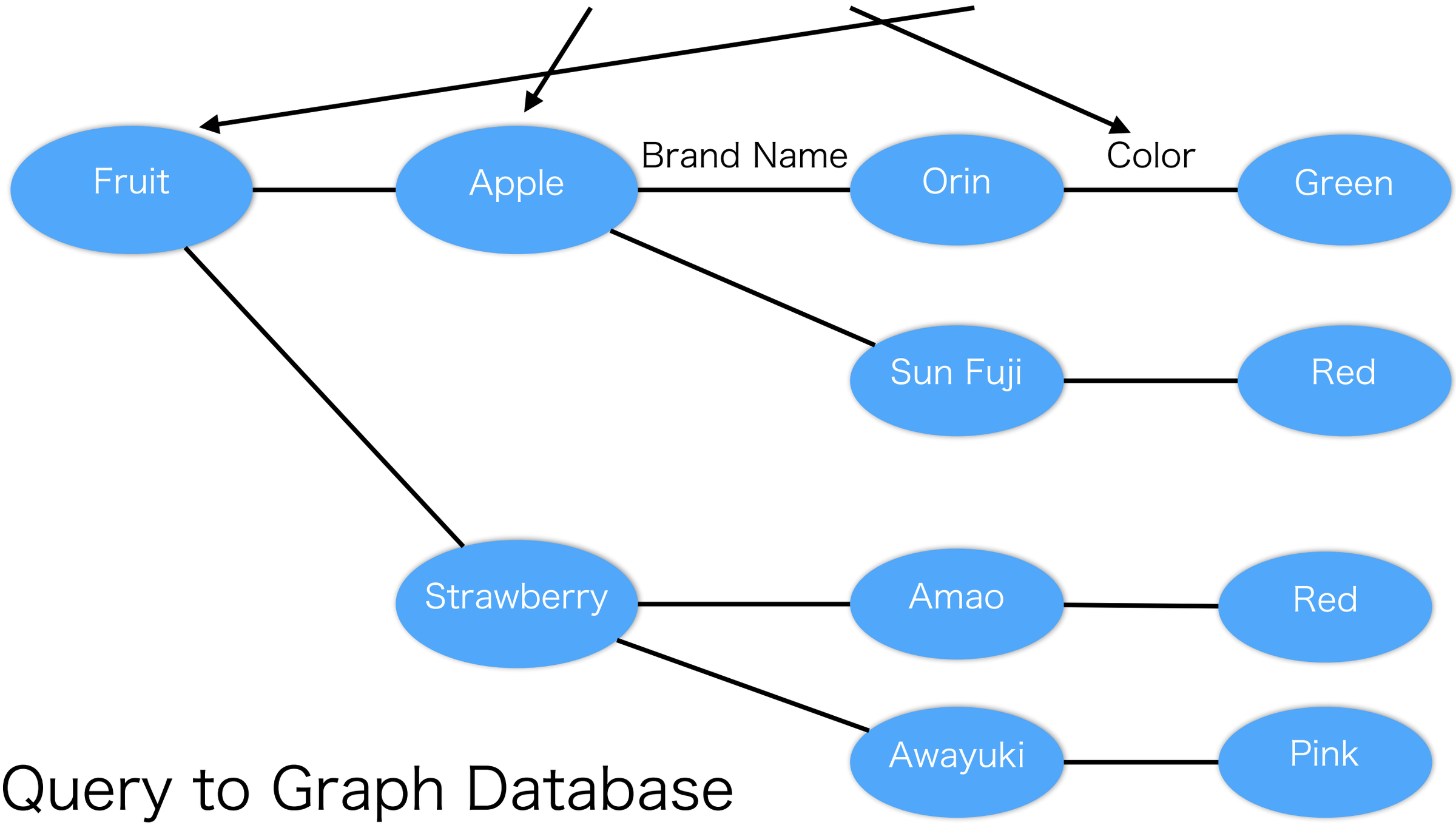
Robotic process automation (or RPA) is an emerging form of business process automation technology based on the notion of software robots or artificial intelligence (AI) workers.[1]
In traditional workflow automation tools, a software developer produces a list of actions to automate a task and interface to the back-end system using internal application programming interfaces (APIs) or dedicated scripting language. In contrast, RPA systems develop the action list by watching the user perform that task in the application's graphical user interface (GUI), and then perform the automation by repeating those tasks directly in the GUI. This can lower the barrier to use of automation in products that might not otherwise feature APIs for this purpose.
https://en.m.wikipedia.org/wiki/Robotic_process_automation

Extended Intelligence(EI, XI)

Talk of AI has become hard to avoid due to surging investment from companies hoping to profit from advances in machine learning. Ito believes the term has also become tainted by the assumption that humans and machines must be in opposition—think debates about jobs stolen by robots, or superintelligence threatening humanity.
“Instead of thinking about AI as separate or adversarial to humans, it’s more helpful and accurate to think about machines augmenting our collective intelligence and society,” Ito says. (Ito is a regular contributor to WIRED’s Ideas section.)
https://www.wired.com/story/a-plea-for-ai-that-serves-humanity-instead-of-replacing-it/

Knowledge Base

Can you find the names of red fruit?



Query to Graph Database

Natural Language Processing

- Part-of-text Tagging
- Parsing
- Named entity extraction

e.g.) I like a big meet pie.

Application

- Machine translation
- Sentiment Analysis
- Automatic summarization

Machine Learning

- Supervised learning
- Unsupervised learning
- Reinforcement learning

Deep Learning

Image Recognition

Speech Recognition

Natural Language Processing

Knowledge Base

Example of Clinical Data Process

knowledge Base

SDTMIG + Extra

ADaMIG + Extra

FDA Guidelines
PMDA Guidelines

Clinical Raw data
Protocol
SAP

SDTM Datasets
define.xml
AnnotatedCRF
SDRG

ADaM Datasets
define.xml
ADRG

TFLs

Example of Clinical Data Process

Protocol
SAP
…Other…

Entity Extraction

Named Entity

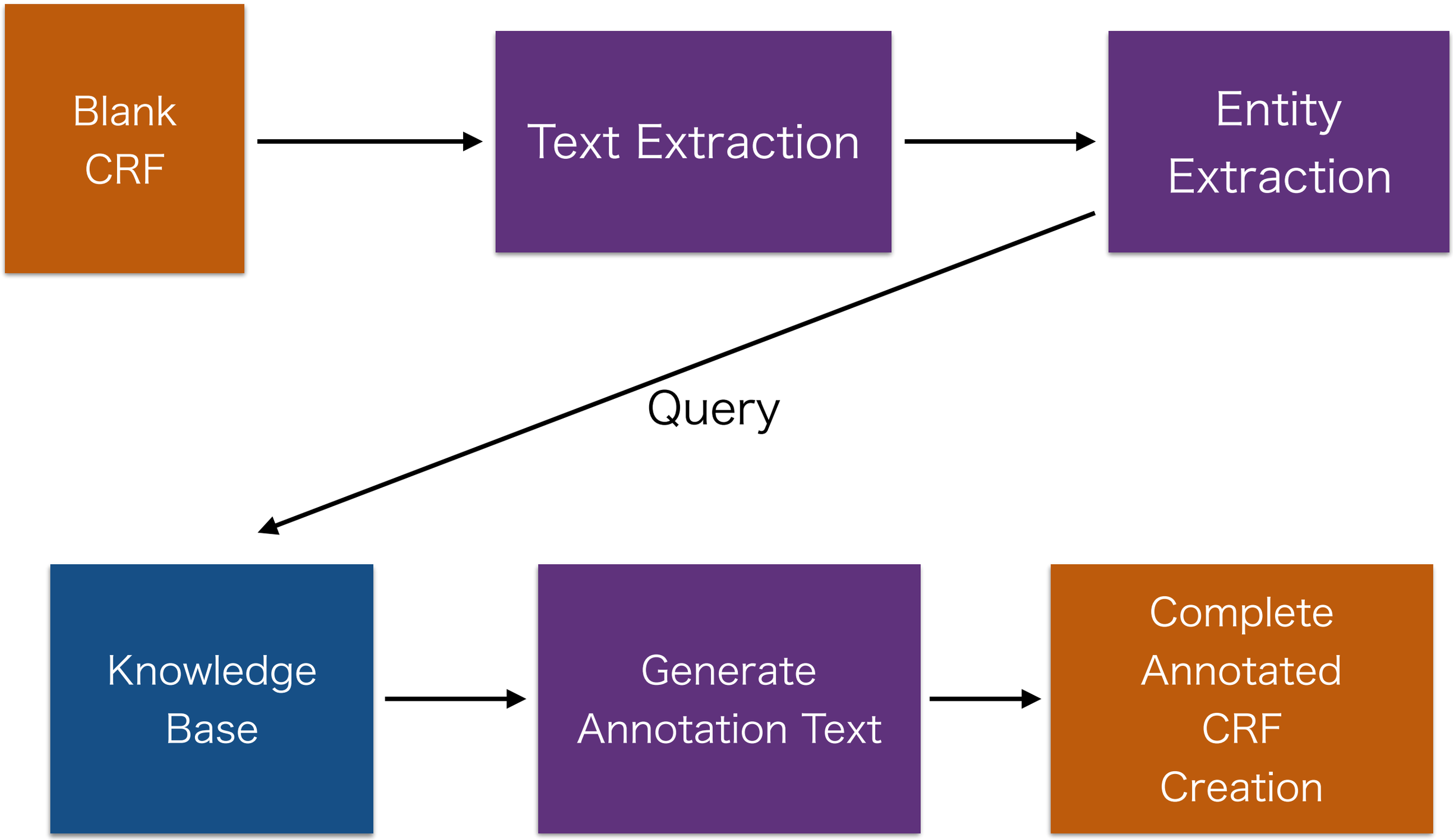
SPARQL
Query

Knowledge Base
as Linked Data

Query
Results

Deliverables
dataset
define.xml
ACRF

USE CASE : Annotated CRF Creation



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