

Situational Knowledge on Demand: Information Extraction from Multimodal Data for Knowledge Graph Construction

To capture semantic similarities between the data, initial connections between information in store and the new data that is streaming in should be identified. These new entities may describe the existing topic or be related to each other through existing relation or through time/place.

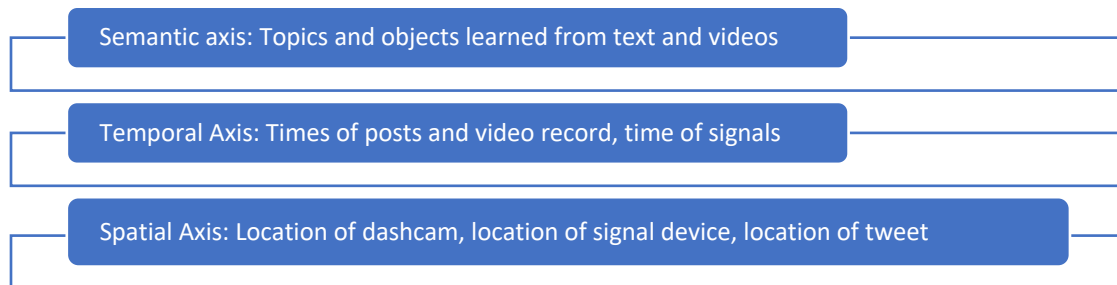
Therefore, there can be at least 3 types of connection levels:

- 1) **Semantic** connection: if the objects can be identified as those related to entities that are already in the KG, a new node is added. This can be a node describing a named entity recognition or a general concept.
 - a. Relation extraction between named entities: depending on the domain, there is usually a pre-defined set of relations, e.g. social, affiliation, physical relations ("works at", "visited", "located")
 - b. Relation extraction between general concepts: DBPedia, ConceptNET
- 2) **Temporal** connection: if the time of the new event is known, a connection is added to the temporal representation of the KG.
- 3) **Geographical** connection: if the location of the new event is known, a connection is added to the spatial representation of the KG.

These three types of connections can be extracted together or only one or two of them can be established depending what type of data can be extracted.

To summarize:

Three dimensions (semantic, temporal, geographical) are added to the Knowledge graph as events are streamed in and recognized. Additional connections are learned for the events with similarities (similar semantics and/or the same location and/or happening at the same time).



Example:

1. Person P1 makes a post about topic B. Person P1 makes a post about topic B. Topic is identified through NLP algorithms (e.g. LDA)
2. The post contains information about certain location L and time T.
3. Camera is installed at location L, objects O1 and O2 identified through video object detection/recognition algorithms (e.g. YOLO NN)

The following connections can be made:

Semantic connection between P1, P2 and B, detected objects O1 and O2 that are extracted at time T can be connected to B through spatial connection.

Result: new connection between topic B and objects O1, O2 is established.

At the beginning, domain-specific entities, relations and important features are described in the initial knowledge graph or a skeleton graph, which can be grown as more and more data becomes available.

Once constructed, KGs can be used to predict new links and provide information that is of interest to the users based on their previous searches and new data that is coming in and added to the KG in real time. Depending on the domain and the purpose of the KG, it can be modified and expanded with additional artifices, such as second-order entities, events, locations and times as the arguments, and so on. These additional data can be extracted from static sources, such as Wikipedia articles, archive of the police dispatch reports, etc.