In this paper, we present CogNet, a knowledge base (KB) dedicated to integrating three types of knowledge: (1) linguistic knowledge from FrameNet, which schematically describes situations, objects and events. (2) world knowledge from YAGO, Freebase, DBpedia and Wikidata, which provides explicit knowledge about specific instances. (3) commonsense knowledge from ConceptNet, which describes implicit general facts. To model these different types of knowledge consistently, we introduce a three-level unified frame-styled representation architecture. To integrate free-form commonsense knowledge with other structured knowledge, we propose a strategy that combines automatically labeling and crowdsourced annotation. At present, CogNet integrates 1,000+ semantic frames from linguistic KBs, 20,000,000+ frame instances from world KBs, as well as 90,000+ commonsense assertions from commonsense KBs. All these data can be easily queried and explored on our online platform, and free to download in RDF format for utilization under a CC-BY-SA 4.0 license.

The demo and data are available at http://cognet.top/
and further link them with structured knowledge from other KBs (FrameNet, YAGO, Freebase, DBpedia and Wikidata). At present, CogNet integrates 1,000+ semantic frames from linguistic KBs, 20,000,000+ frame instances from world KBs, as well as 90,000+ commonsense assertions from commonsense KBs. In addition, we establish an online platform, providing a unified engine to query and explore all these knowledge resources.

**Methods**

As shown in Figure 1 in CogNet, we model knowledge in three levels of frame-styled representations, namely Semantic Frame (SF), Frame with Element Restriction (FER), and Frame Instance (FI), forming a chain from abstract to concrete: SF→FER→FI. We design different integrating strategies for each level as follows.

**Semantic Frame** We take SFs and their attached frame elements (FEs) from FrameNet as the core of CogNet, which provides linguistic knowledge about particular situations, objects and events. As illustrated in the upper rounded rectangular box in Figure 1, SF Commerce_buy is associated with FEs like Buyer and Goods. We utilize SFs from FrameBase, which has converted FrameNet into an RDF schema. To extend its coverage, we update it with the latest data from FrameNet 1.7 as well as the Chinese FrameNet (Hao et al. 2007). In addition, we enrich the relations of SFs with commonsense knowledge from ConceptNet.

**Frame with Element Restriction** We introduce FER nodes to represent natural language phrases, which extensively exist in free-form commonsense KBs and actually describe frames and their element restriction. For example in “buy book”→“hasPrerequisite”→“go to bookstore”, “buy book” tells us the type of Goods. As illustrated in the middle rounded rectangular box in Figure 1, we convert the phrase into a FER, which concretizes SF Commerce_buy and is associated with a restriction that the FE Goods belongs to Book type. We extract FERs from ConceptNet via three steps: (1) parsing the concepts into frames with their elements through automated and crowdsourced methods; (2) disambiguating the FEs in the last step and linking them to WordNet taxonomy; (3) connecting FERs generated in previous steps with commonsense relations. Note that a concept from ConceptNet could be mapped to either a FER or a frame, depending on its content. That is why there are two arrows from ConceptNet in Figure 1.

**Frame Instance** We represent world knowledge facts from different sources as FIs. In a FI, FEs are bound with specific objects or literals. For example, as shown in the lower rounded rectangular box in Figure 1, “Emile bought Hamlet” is corresponding to a FI where Buyer is Emile and Goods is Hamlet. We extract FIs from YAGO, Freebase, DBpedia, and Wikidata based on SPARQL rules of FrameBase, and merge the same entities from different sources. Further, we connect FIs with FERs through “concretize” relations if there are just some FERs describing the corresponding general situation.

**Online Platform**

We develop an online platform for access to CogNet data, including key-word querying and top-down exploring.

**Querying** We provide an interface for unified queries of different types of knowledge, which can return a list of candidate nodes according to the query. Specifically, the system can detect frame names or lexical units in the query and find the corresponding semantic frames. Then, it can find FERs and entities involved in FIs by fuzz-matching the query with their labels. Finally, the system can aggregate the results and return them to users. Besides the easy-using interface for ordinary users, we provide SPARQL query service to skilled users so that they can implement more complex queries.

**Exploring** As CogNet is organized with different levels of frame representations, we provide a top catalog for semantic frames, from which users can explore knowledge from the top down via “concretize” relations. For each SF, FER, FI, and entity involved in FIs, we provide a page to show its description and relationship to other nodes. A typical page is shown in Figure 2. We display the label, frame elements,
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