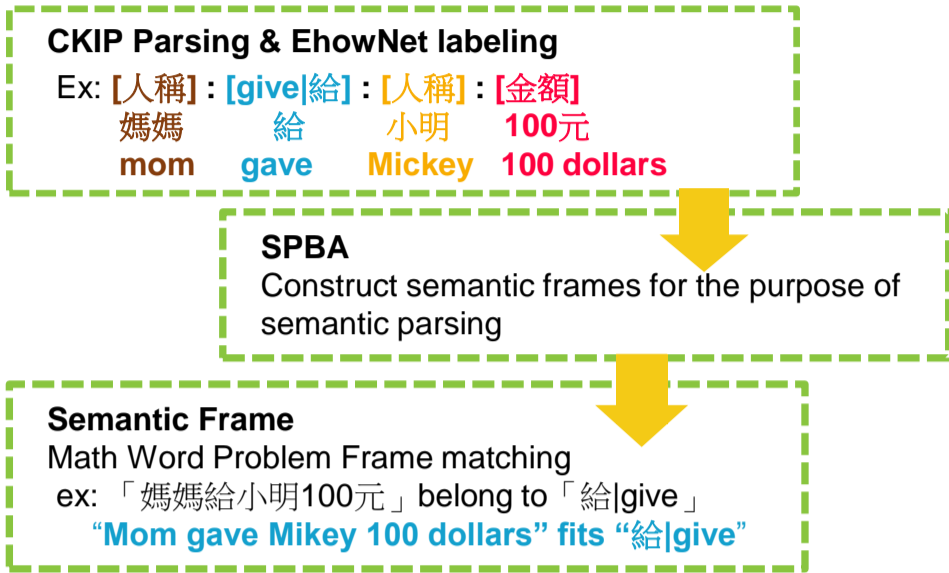


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- This Project aims at developing an intelligent learning assistant (ILA) for primary school math word problem (MWP) whose modules could help us to create dialogues. With automatic text generation techniques via SPBA (Statistical Principle-based Approach), our ILA is expected to talk in a natural and human-like fashion. Applications include solving primary school math word problems and assisting the teaching of writing.
- Deep natural language understanding
- Automatic pattern learning and generation through SPBA

Knowledge representation : Constructing semantic frames for the main concept in sentences

The basis of this ontology is E-HowNet and semantic role frames.

- There are 60+ verb frames
- Hundreds of noun frames
- Semi-automatically built ontology

Entailment analysis : Knowing things unwritten but implicitly implied.

ex: "buy" implies someone spends money to get something from shop.

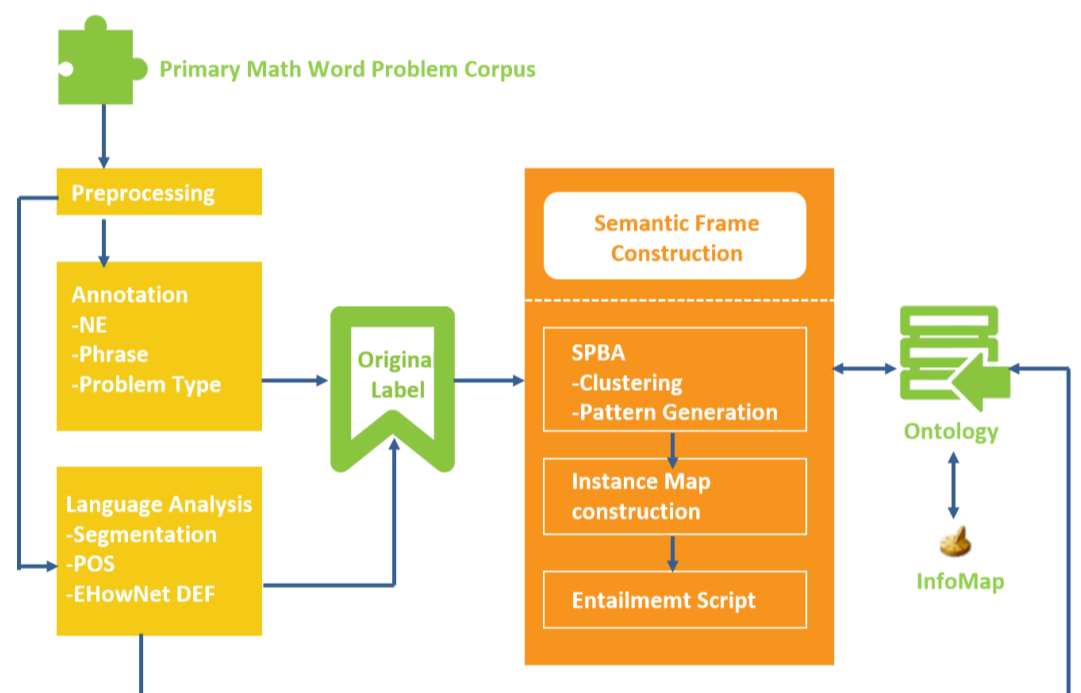
- Linguistic knowledge and common sense require ontology to store and document

Natural language script : Convert simple natural language sentences to flow control programs

Explanation generation : Obtaining semantic frames and constructing solution scripts

Generate step-by-step guide for students

- Learning predefined sentence templates
- Paragraph representation and generation



Flowchart of ILA in primary Math word Problem solving system

奶奶今年81歲，姐姐年齡的7倍少3歲剛好和奶奶的年齡一樣，姐姐今年幾歲？

----- new student -----

student: 奶奶今年81歲，姐姐年齡的7倍少3歲剛好和奶奶的年齡一樣，姐姐今年幾歲？

teacher: 因為姐姐年齡的7倍所以列出: 姐姐年齡 * 7

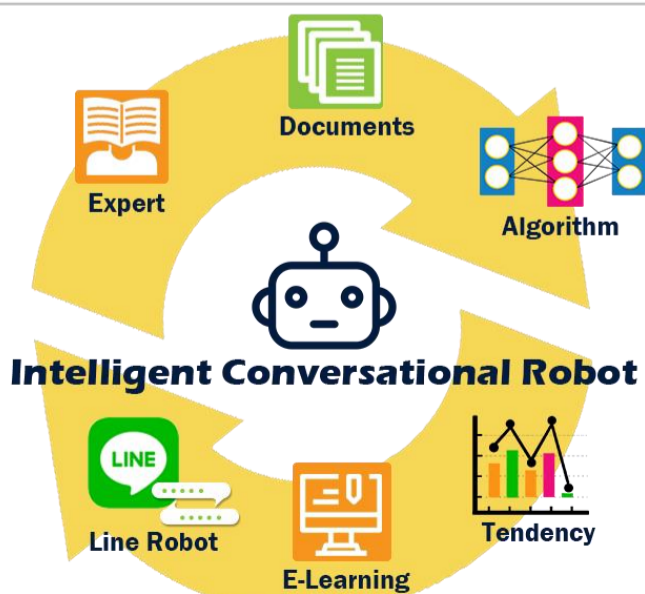
teacher: 因為姐姐年齡的7倍少3所以列出: 姐姐年齡 * 7 - 3

teacher: 奶奶今年81歲

teacher: 由式子 $7 * \text{姐姐年齡} - 3 = 81$ ，做移項和合併項後，變成 $7 * \text{姐姐年齡} = 84$ ，解得 $\text{姐姐年齡} = 84 / 7 = 12$

teacher: 姐姐今年12歲

Generating step-by-step explanations



Expected results and impact

- Semi-automatic ontology construction
- Natural language editor and inference engine
- MWP dialogue system
- Intellectual tutor of MWP for countryside children
- Build an example of explainable AI (XAI)
- Exploring deep natural language understanding