# EDUQA : EDUCATIONAL DOMAIN QUESTION ANSWERING SYSTEM USING CONCEPTUAL NETWORK MAPPING

*A Agarwal^, *N Sachdeva^, *R K Yadav^, * V Mittal^, *V Udandarao^, A Gupta^, A Mathur^^

^SBILab, Department of ECE, IIIT-Delhi, India,
^^ Million Sparks Foundation

# INTRODUCTION

- **Problem** : QA system for the K-12 Education system
- **Proposed Solution**: EDUQA : Framework to extract meaningful answers using - Concept Network - context information encoded into a network of evolving entities

# BACKGROUND

Question Answering Models are of 2 types:

- **Open Domain**: Eg. DrQA*, etc
- **Closed Domain**:Eg BiDAF**, QuASE*** etc

*D. Chen, A. Fisch, J. Weston, and A. Bordes. E et al,
**M. Seo, A. Kembhavi, A. Farhadi, et al,
***H. Sun, H. Ma, W.-t. Yih, C.-T. Tsai, J. Liu, and M.-W. Chang, et al

# BACKGROUND

Drawbacks :

- **Open Domain**: variation in level of understanding, factoid based
- **Closed Domain**: factoid based, rote learning, not good enough as standalones *

* T. Atapattu, K. Falkner, and N. Falkner et al,

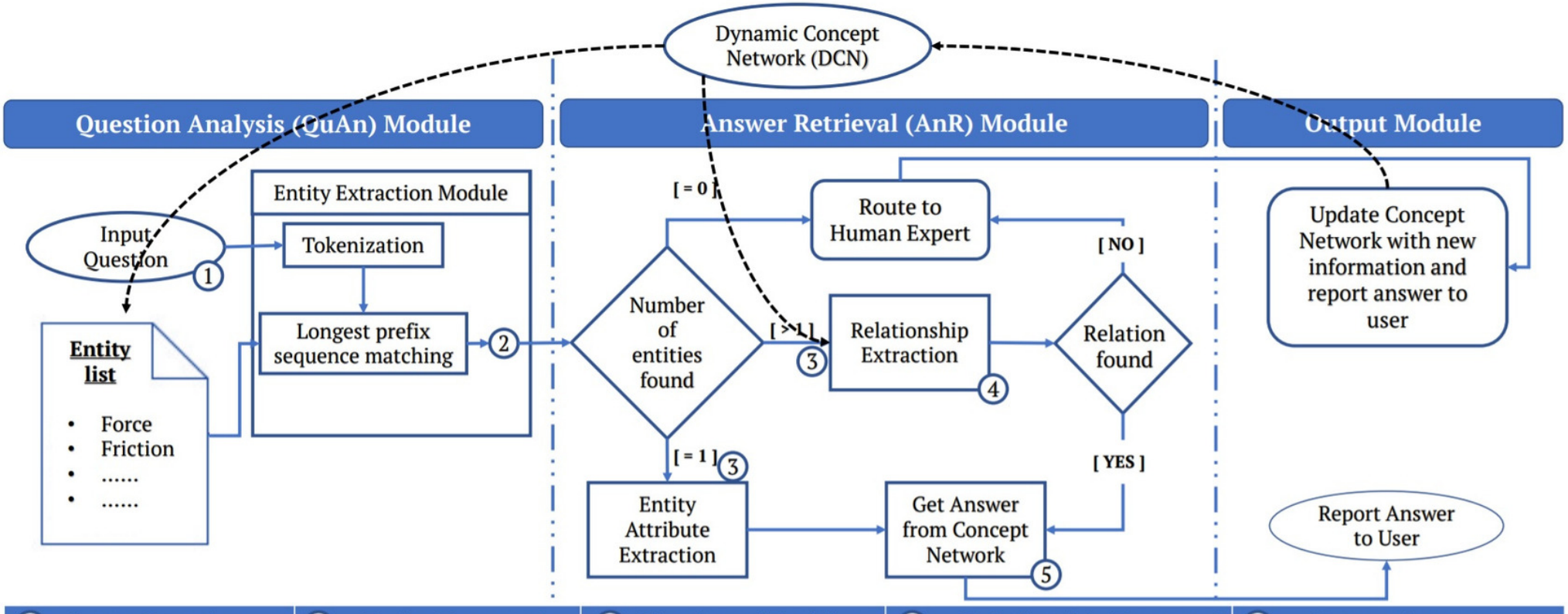
# BACKGROUND

Other drawbacks of various question answering models:

- **Answer retrieval using rote learning**
- **Inability to capture semantic correlations within question**
- **Support mostly for factoid type questions**
- **Not resourceful for answering student queries**

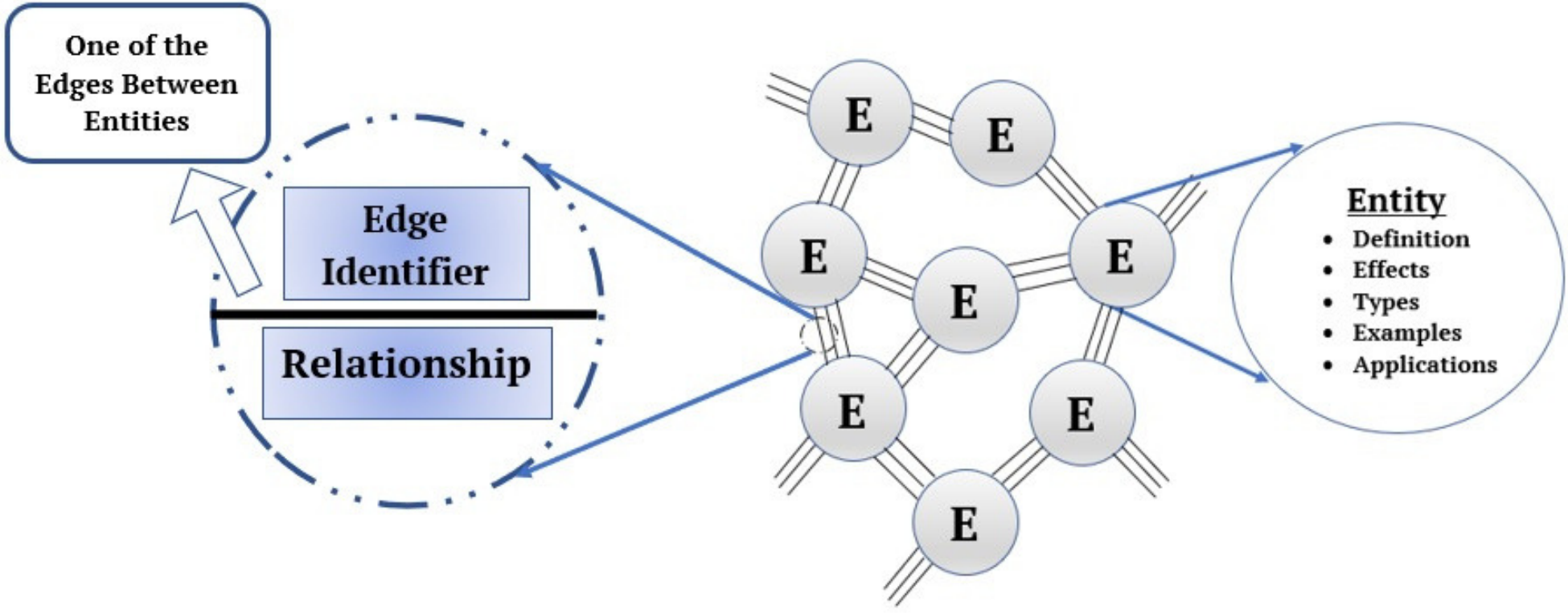
PROPOSED FRAMEWORK:

# EDUQA: EDUCATIONAL DOMAIN QUESTION-ANSWERING SYSTEM




| 1 Input Question | 2 Entity Extracted | 3 Number of Entities | 4 Relationship Extracted | 5 Output Answer |
|---|---|---|---|---|
| Define Force. | Force | 1 | N.A. | Force is a push or a pull.... |
| Relate force to pressure. | Force, Pressure | 2 | Related To | Pressure is directly... |

# 1 Dynamic Concept Network(DCN) Module


One of the Edges Between Entities
Edge Identifier
Relationship
E
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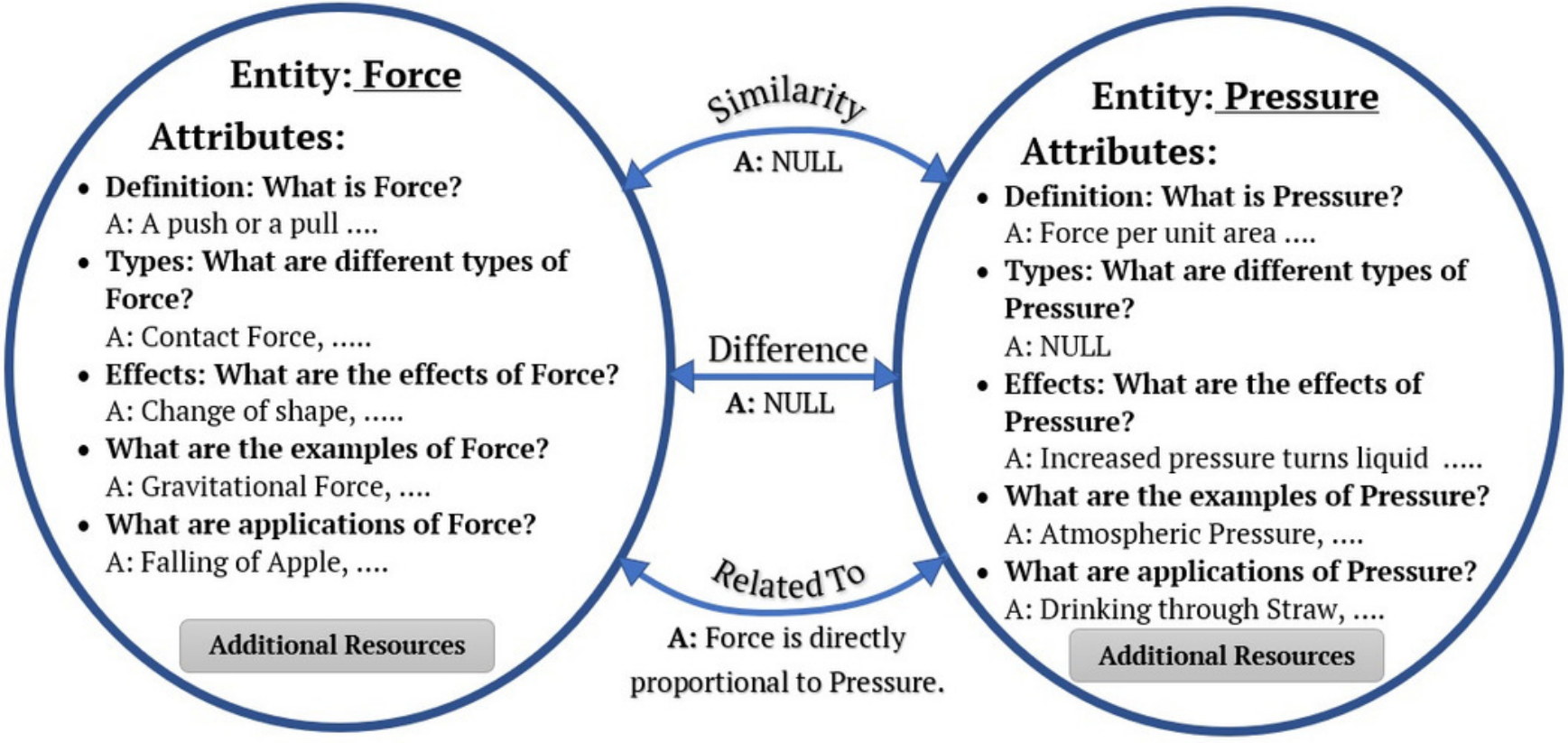
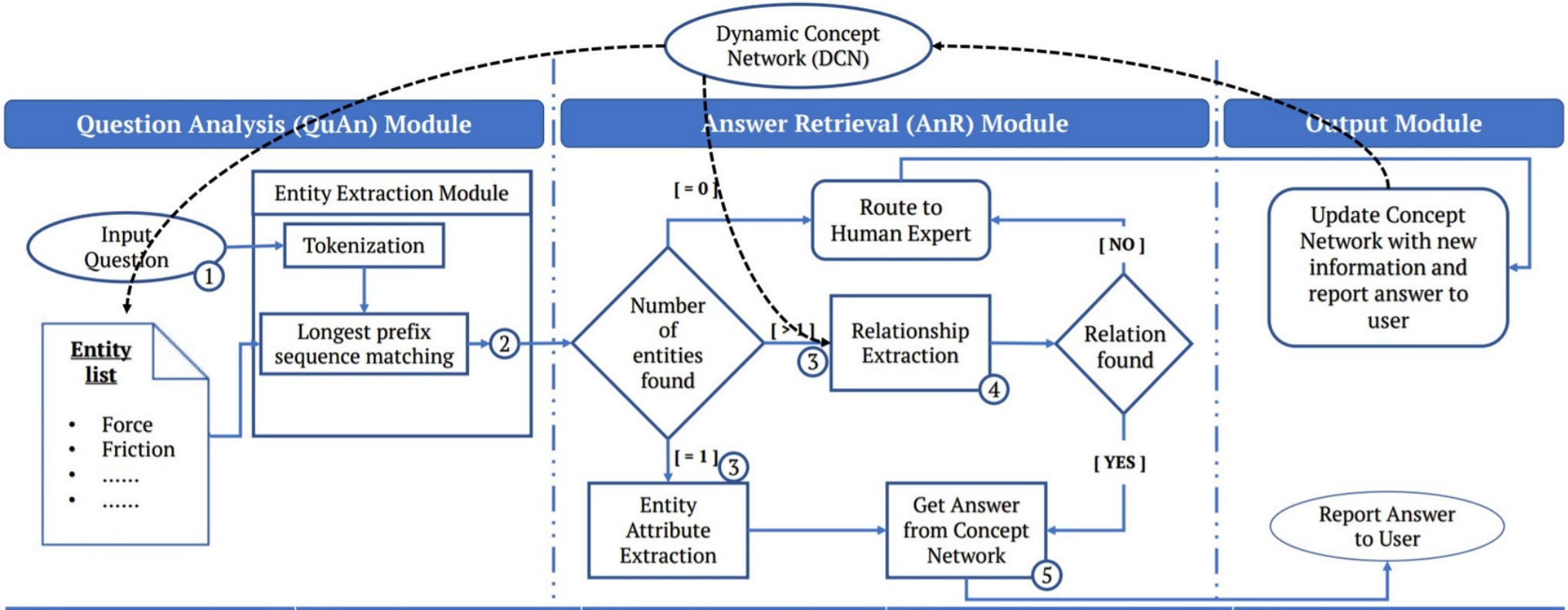
Entity
Definition
Effects
Types
Examples
Applications

# ENTITY (NODES) AND RELATION (EDGE)



# ON THE FLY LEARNING

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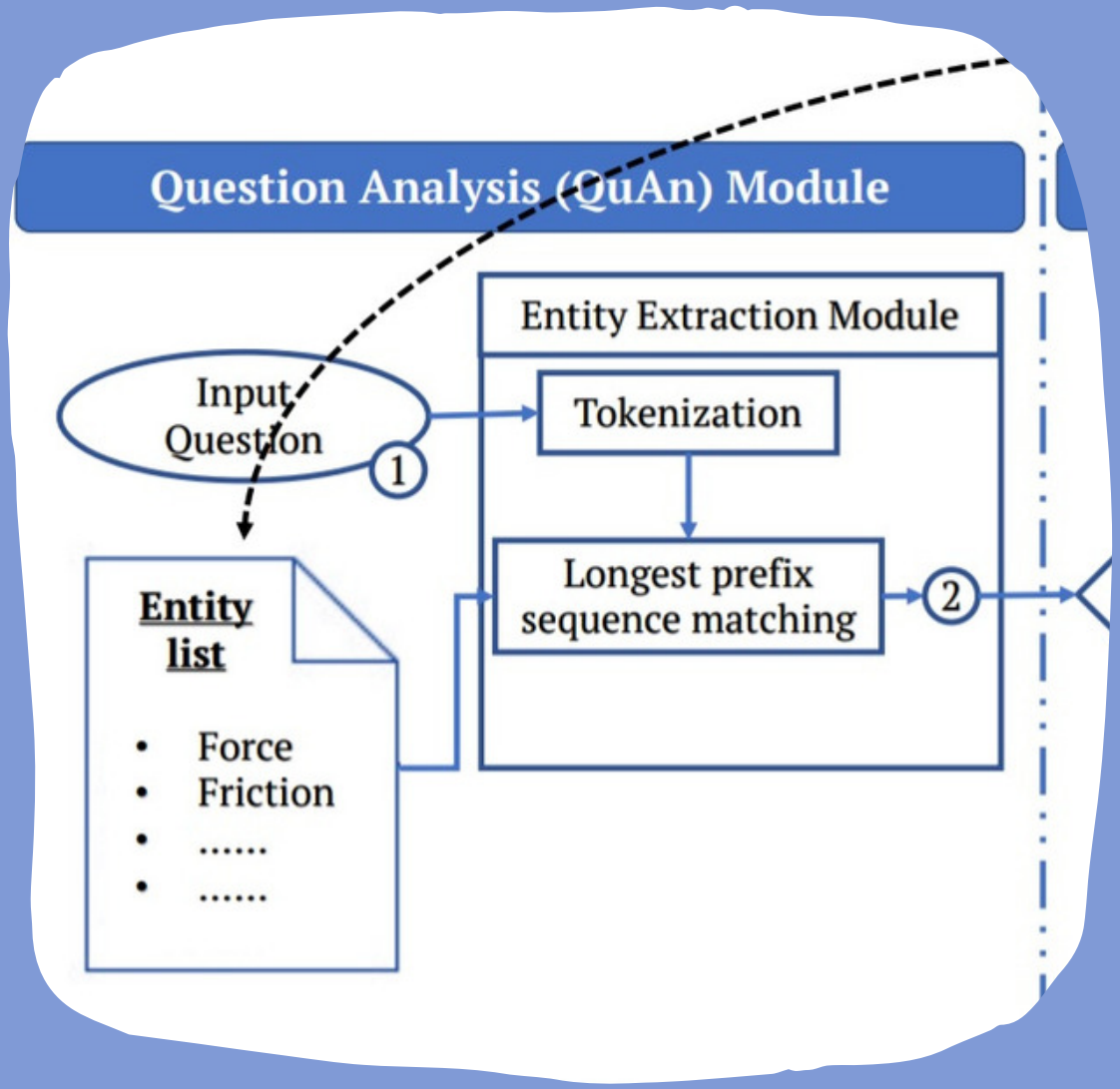
# 2 Question Analysis (QuAn) Module



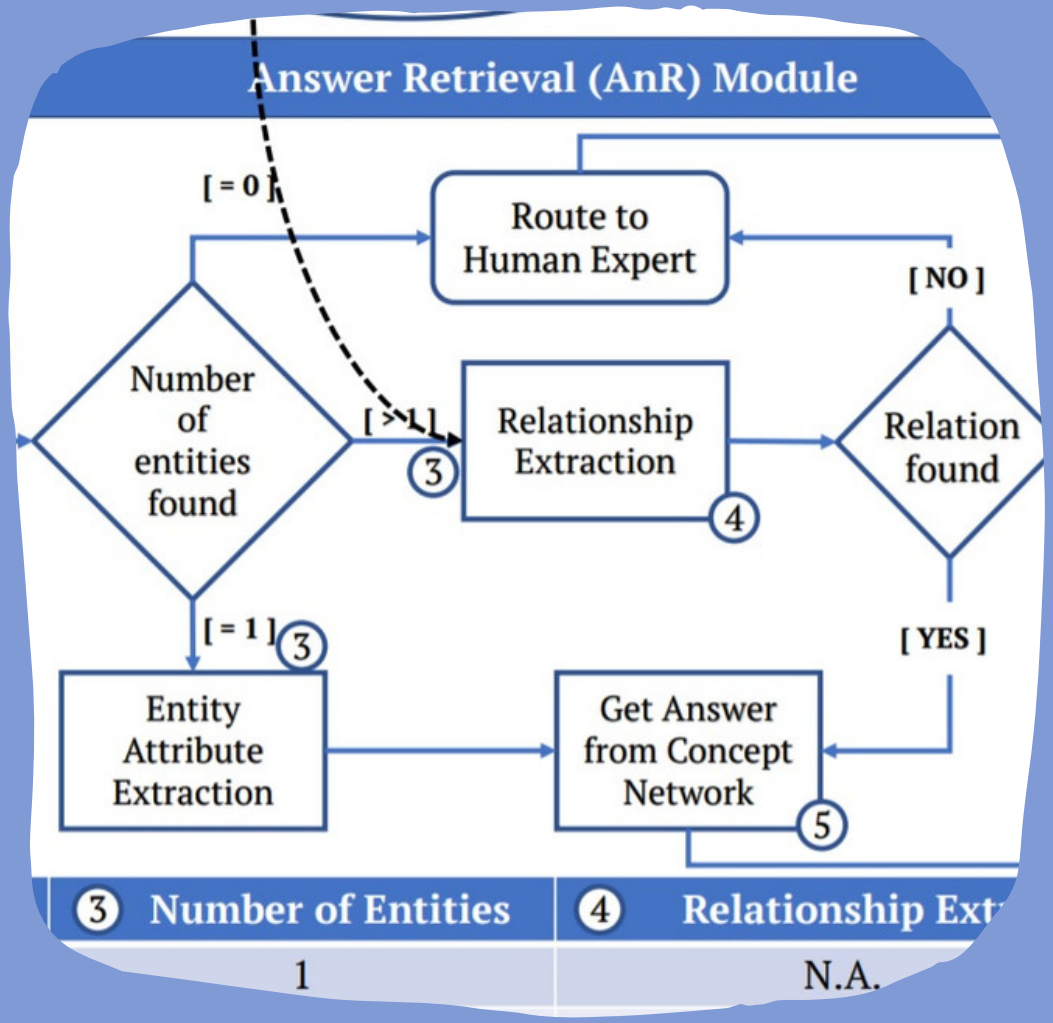
- **Entity Extraction Module - Tokenization + Longest Prefix Sequence matching (LPSM)**
- Eg :Question: "What is non contact force"

  Tokenization: "What", "is", "non", "contact", "force"

  Subset of Entity list: "non contact force", "contact force", "force"

  LPSM : "non contact force"

# 3 Answer Retrieval (AnR) Module



- Attribute Recognition – similarity measure of entity attributes and input question *

$$Sim_{overall} = (1 - \delta) Sim_{statistic} + \delta Sim_{semantic},$$

- Relationship Extraction – more than one entity in the question

# RESULTS

**Table 3:** Comparison of EDUQA with other models

| **Sample Question** | **EDUQA** | **BiDAF [6]** | **START [4]** |
|---|---|---|---|
| What is Force? | ✔ | Λ | Λ |
| What is change in state of motion? | ✔ | ✘ | — |
| Give examples of Non-Contact Force. | ✔ | ✘ | ✔ |
| What brings change in state of motion? | # | ✘ | — |
| What happens to pressure when force increases? | ✔ | ✘ | — |
| Differentiate between contact and non-contact force. | ✔ | Λ | ✘ |
| What happens when two forces act in the same direction? | # | ✔ | — |

✔ Correct Answer ✘ Wrong Answer — No Answer # Expert's Answer Λ Partially Correct

# CONCLUSION

- Explored Question Answering – Education
- Analysis of existing frameworks and their shortcomings in educational context
- Proposed framework - based on dynamic self - evolving concept network (built specific to a topic)

# FUTURE WORK

- Use better answer retrieval strategies
- Incorporating complex courses like Mathematics
- automate concept network construction
- minimize requirement of human expert at back end
- support for complex reasoning questions

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# THANK YOU !