Automatic Interpretation of Diagrammatic Arrows

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Why focusing on arrows?

Because understanding the meaning of arrows is a key issue to develop useful pen-input interfaces.

If computers understand the diagrams drawn by us, we can operate information systems more intuitively.
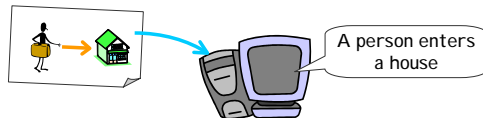
Arrows are seen in many diagrams …

Follow this way.

Search the image like this

Simulate this mechanism
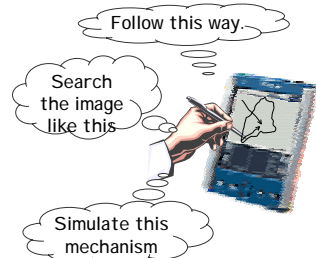
and they represent various semantics, like

movement, direction, interaction, causality …

Research Goal

To develop a computational method for interpreting the meaning of arrows
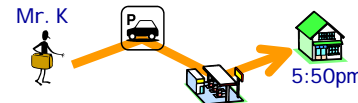
A person enters a house

Approach

STEP 1
Enumerate all possible interpretations.

STEP 2
Determine the most reliable interpretation.

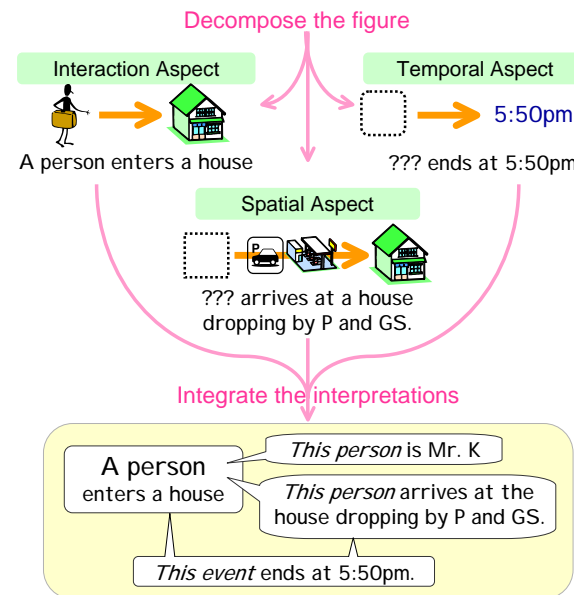STEP 3
Refine the adopted interpretation.

STEP 1: Enumerate all possible interpretations

Q. How do we interpret the figure with an arrow, like the following figure?

Mr. K   5:50pm

A. The arrow is decomposed into three portions, which represents three aspects of the arrow's semantics. Then, the partial interpretations are determined from the structure of each portion, and finally they are integrated to remove the ambiguities.

Decompose the figure

Interaction Aspect

A person enters a house

Temporal Aspect

5:50pm

??? ends at 5:50pm

Spatial Aspect

??? arrives at a house dropping by P and GS.

Integrate the interpretations

A person enters a house

This person is Mr. K

This person arrives at the house dropping by P and GS.

This event ends at 5:50pm.

STEP 2: Determining the most reliable interpretation

Q. An arrow may have multiple interpretations. In such a case, can we decide which interpretation is more reliable?

A person gets out of a car.

A car approaches to a person (and crushes !?)
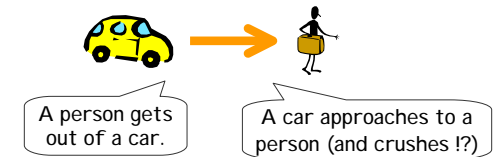
A. The validity of each interpretation is examined using the various clues in the figure.

What are clues in the following figures?

1.   4.

2.   5.

3.
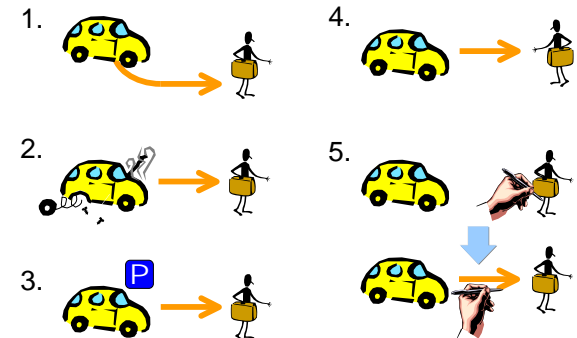
We can distinguish that Fig. 1, 2, and 3 means 'a person gets out of a car,' while Fig. 4 and 5 means 'a car approaches to a person,' because each figure contains the following clues:

1. Arrow's connecting angle
2. Entity' s mobility
3. Context
4. Entity's orientation
5. Drawing order

STEP 3: Refine the adopted interpretation

The interpretations deduced by the current method is actually too generic. Thus, we are now challenging to refine the interpretations, such that they sound as natural as human expressions. It requires the background knowledge about entities——how entities changes and interacts..

Next Challenge!

Now: Input (a person, a house)
Future: A person *enters* a house.