Introduction to Intelligent Systems

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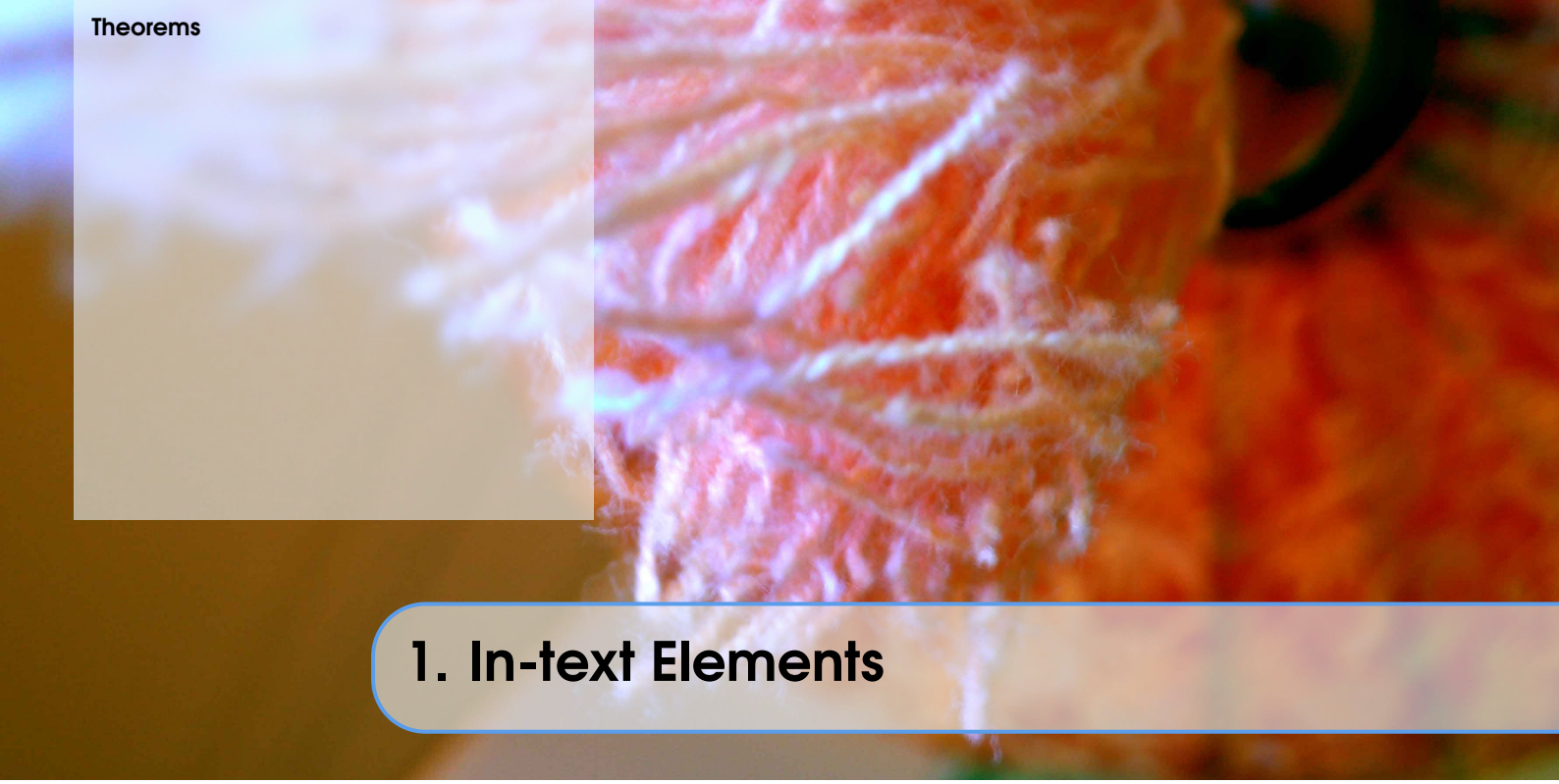

1. In-text Elements

1.1 Theorems

2. Knowledge Representation

2.1 Representation

AI agents deal with knowledge(data).

- Facts
- Procedures
- Meaning (relate & define knowledge)

Right representation is crucial

- Early realisation in AI
- Wrong choice can lead to project failure
- Active research area

2.1.1 Choosing a representation

For certain problem solving techniques.

- Best representation already known
- Often a requirement of the technique
- Or a requirement of the programming language(e.g. Prolog)

Representation of:

- Declarative knowledge(what, objects, structure)
- Procedural knowledge(how, actions, performance)

2.2 Aspects of Knowledge representation

Syntax:

- Possible (allowed) constructions
- For example: colour(my_car, red), my_car(red), red(my_car), etc.

Semantics:

- What the representation **means** (and how it maps to the real world)
- Example:
  - Colour(my_car, red) means: "my car is red", "paint my car red", etc.

Requirements for Knowledge Representation languages:

Representation adequacy:

- Should allow for representing all the required knowledge

Infernal adequacy:

Inferential efficiency:

Clear syntax and semantics:

Neutralness:

2.3 What is a Logic

A language with concrete rules.
No ambiguity in representation, however there may be errors. Allows for unambiguous communication and processing.
Is very unlike natural languages like e.g. English.

2.3.1 Non-logical representation

Logic representation have restrictions and can be hard to work with.

2.3.2 What we've ignored

Objects in the world tend to be related to each other.

- Classes, superclasses & subclasses, part / whole hierarchies
- Properties are *inherited* across relationships

The state of the world can change over time.

- Explicit representation of time
- Frame problem: representing the effects of action in logic without having to represent explicitly a large number of intuitive obvious non-effects
- Non-monotonic reasoning

We must reason without complete knowledge

- Closed world assumption

Not all knowledge is "black & white":

- Uncertainty, statistics, fuzzy logic,...

Defaults and exceptions:

Exception for a single object, a property of the object must be set to the (exception) value.

2.4 Semantic Networks

Semantic networks are essentially a generalization of inheritance hierarchies.
Each node is an object, class, concept, or event.

Each link is a relationship.

- is-a (the usual sublcass or element relationship
- has-part or part-of
- any other relationship that makes sense in context(e.g. owns thing x)

Semantic networks represent knowledge as a network or graph(easily stored on the computer).
By traversing the network we can find:

- Elephant x likes apples(by inheritance)
- That certain concepts related in certain ways(e.g. apples and elephants)

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