CS50: Introduction to Artificial Inteligence Notes

Noah Peters

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Abstract

CS50: Introduction to Artificial Inteligence notes. Note template by Pingbang Hu.

Contents

Chapter 1

Knowledge

1.1 Propositional Logic

We use standard logic notation:

- $\neg p$
- $p \vee q$
- $p \wedge q$
- $p \Rightarrow q$:

p	q	$p \Rightarrow q$
false	false	true
false	true	true
true	false	false
true	true	true

- $p \Leftrightarrow q$:

p	q	$p \Leftrightarrow q$
false	false	true
false	true	true
true	false	false
true	true	true

Now we must establish *what* is considered to be "true" in our world by defining a **model**. We need to represent that knowledge. We do so by defining it via a **knowledge base**.

Definition 1.1.1 (Model)**.** Assignnment of a truth value to every propositional symbol.

Definition 1.1.2 (Knowledge Base)**.** A set of sentences known by a knowledge-based agent.

Definition 1.1.3 (Enatilment)**.**

$$\alpha \models \beta \text{ ''}\alpha \textit{ entails } \beta\text{''}$$

In every model in which sentence α is true, sentence β is also true.

1.2 Inference

Our aim is to see if our knowledge base, KB, entails some query about the world, α:

$$KB \models \alpha?$$

We first define a **model checking algorithm** to determinne if $KB \models \alpha$. We can deermine this by doing the following:

- enumerate all possible models
- if in every model where KB is true, α is also true, then $KB \models \alpha$

1.3 Inference By Resolution

To determine if $KB \models \alpha$ via knowledge resolution:

- Check if $KB \wedge \neg\alpha$ is a contradiction
  - Conver $KB \wedge \neg\alpha$ tto Conjunctive Normal Form
  - Keep checking to see if we can use resolution to produce new clause
  - If we ever produce the empty clause (equivalen to False), we have a contradiction and so $KB \models \alpha$
- If so, then $KB \models \alpha$
- Otherwise, no entailment

Problem 1.3.1. Does $(A \vee B) \wedge (\neg B \vee C) \wedge (\neg C)$ entail A ?

Answer. First, we convert to CNF:

$$(A \vee B) \wedge (\neg B \vee C) \wedge (\neg C) \wedge (\neg A)$$

We can resolve $(\neg B \vee C)$ and $(\neg C)$ by concluding that $\neg B$. With the knowledge of $\neg B$ we now see that, considering $A \vee B$, we can conclude A. We see that

$$A \wedge \neg A \Rightarrow False$$

and so we can conclude that the clause entails A. ⊛

Chapter 2

Probability

Lecture 2: Second Lecture

2.1 Introduction

9 Sep. 08:00

Appendix