Normative Reasoning Overview and Challenges

February 15, 2020

Table of Contents

- Basic Notions
- Normative Systems
- ► Excursion: Bayesian Networks
- Challenges

What is normative reasoning?

Normative reasoning is to reason about evaluation or value judgement.

A norm in this context is a standard for evaluating and judging behaviour or outcomes as good (desirable, permissable etc.) or bad (undesirable, impermissable etc.).

What is normative reasoning?

Normative reasoning is to reason about evaluation or value judgement.

A norm in this context is a standard for evaluating and judging behaviour or outcomes as good (desirable, permissable etc.) or bad (undesirable, impermissable etc.).

Disclaimer:

- ▶ We will choose this particular definition for our presentation. There are other definitions of normative.
- ▶ We make a distinction between beliefs and intentions.

Practical reasoning versus normative reasoning

Practical reasoning is to reason so that the conclusion is an intention. In pure normative reasoning we only reason about normative beliefs. We can of course mix both.

Practical reasoning versus normative reasoning

Practical reasoning is to reason so that the conclusion is an intention. In pure normative reasoning we only reason about normative beliefs. We can of course mix both.

Example: ϕ some verb, P some person P ought to ϕ so P shall ϕ

Practical reasoning versus normative reasoning

Practical reasoning is to reason so that the conclusion is an intention. In pure normative reasoning we only reason about normative beliefs. We can of course mix both.

Example: ϕ some verb, P some person P ought to ϕ so P shall ϕ

The application of normative and practical reasoning is one reason that motivates the study of those systems in machine ethics.

Approaches to normative reasoning

Normative theories cannot tell which beliefs are right but rather what beliefs are *consistent*.

consistent: does not entail a contradiction/ has a model where

Approaches to normative reasoning

It is convenient to differentiate three different approaches to formalize normative reasoning:

- ► Logic consequence of belief
- Probability theory degrees of belief
- Rational choice theory valuing choices

Approaches to normative reasoning

It is convenient to differentiate three different approaches to formalize normative reasoning:

- ► Logic consequence of belief
- Probability theory degrees of belief
- Rational choice theory valuing choices

Motivations:

- ► A.I.
- Standard of comparison for actual behaviour
- Descriptive theories on reasoning
- Philosophy

Approaches to normative reasoning

absolutism vs. pluralism:

Normative systems can often be embedded into each other but differ in expressiveness as in utility for a predefined purpose.

Approaches to normative reasoning

absolutism vs. pluralism:

Normative systems can often be embedded into each other but differ in expressiveness as in utility for a predefined purpose.

Examples:

Logic: proof verification

Probability theory: recurring events

Rational choice theory: optimization, microeconomy

Normative Reasoning Logic

Extremely good to model beliefs on a local level but problems arise when background knowledge is required.

Logic

Extremely good to model beliefs on a local level but problems arise when background knowledge is required.

Example:

All general statements are false.

P is a general statement.

P is false.

What happens if we assume the opposite of the conclusion to be true?

Logic

Extremely good to model beliefs on a local level but problems arise when background knowledge is required.

Example:

All general statements are false.

P is a general statement.

P is false.

What happens if we assume the opposite of the conclusion to be true?

Logic detects the inconsistency but does not tell us what went wrong.

Probability

How can we model different degrees of belief?

Rational Choice

Setting: An individual has a set of choices which is *complete* and *transitive*. We furthermore assume our *rational agent* always makes a cost-benefit-analysis and will always choose the optimum.

Advantage: compact & tractable

Challenges

How to effectively model the entaglement of knowledge? (Frame Problem)

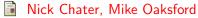
Challenges

- ► How to effectively model the entaglement of knowledge? (Frame Problem)
- ► How to deal with inconsistency?

Challenges

- How to effectively model the entaglement of knowledge? (Frame Problem)
- ► How to deal with inconsistency?
- How to effectively model and compute normative reasoning?

Sources I



Normative Systems: Logic, Probability, and Rational Choice 10.1093/oxfordhb/9780199734689.013.0002

John Broome

Normative Practical Reasoning I 10.1111/1467-8349.00085

R. Philipen and P. McNamara

Handbook of Deontic Logic and Normative Systems, Volume 1, Chapter 1
College Publications 2013, ISBN 078-1-84800-132-2

College Publications 2013, ISBN 978-1-84890-132-2

Paul McNamara

Stanford Encyclopedia of Philosophy: Deontic Logic https://plato.stanford.edu/entries/logic-deontic/

Sources II

Jan Broersen, Stephen Cranefield, etc. Normative Reasoning and Consequence 10.4230/DFU.Vol4.12111.33

Jonathan Levin, Paul Milgrom
Introduction to Choice Theory
http://web.stanford.edu/jdlevin/Econ%20202/Choice%20Theory.pdf