

Multiagent Based Ethical Asset Management

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Table of content

Why ethical concerns in Asset Management

Multi-agent system for Asset Management

Introducing Ethical concerns

Experiments

Conclusion

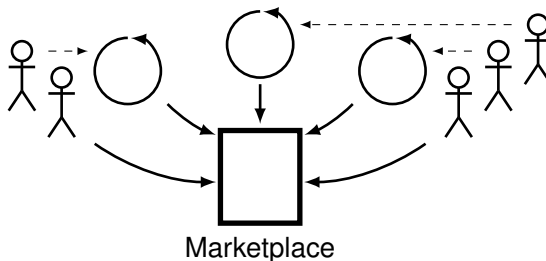
Why ethical concerns in asset management

This paper shows

- ▶ an ethical decision process
- ▶ an implementation in autonomous agents

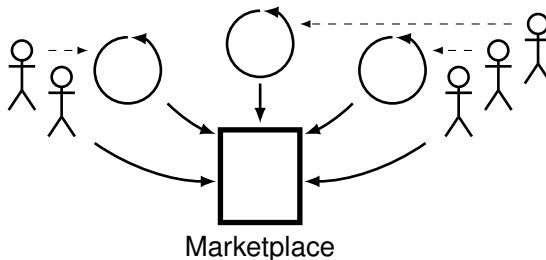
The application domain is ethical asset management, due to variety of existing ethics and morals (Islamic, ecologist, responsible and so on ...)

Multi-agent system for Asset Management



A classic market is typically an open and distributed multi-agent system where heterogeneous agents (including humans) put orders in a centralized marketplace.

Multi-agent system for Asset Management

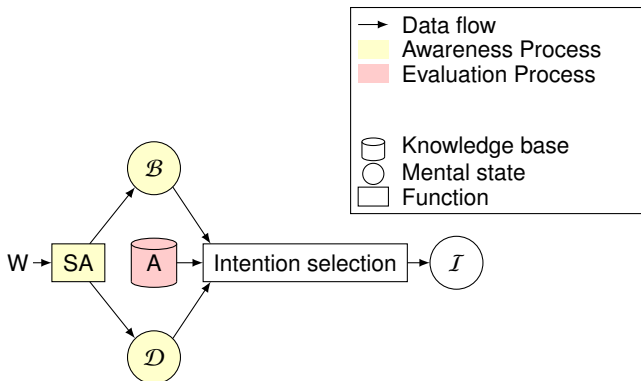


The marketplace is only designed to execute orders and broadcast information. The decision is distributed in the decision process of the agents.

As a consequence, ethical considerations should be implemented in the decision process of their agents.

Introducing Ethical concerns

Classic BDI decision process



A coarse but generic description of any BDI decision process

Introducing Ethical concerns

Introduction of new concepts

Moral Value : an actions in a set of situations may supports a moral value.

$\langle s, v \rangle \in VS$ with $v \in \mathcal{O}_V$ is a moral value and $s = \langle a, w \rangle$ is the support of this moral value, with $a \subseteq A$, $w \subset \mathcal{B} \cup \mathcal{D}$.

Example

- ▶ *Investing in a nuclear energy producer is not ecologist*
- ▶ *Trade assets of ecolabel certified companies is ecologist*

Introducing Ethical concerns

Introduction of new concepts

Moral Rule : an actions or a value support in a set of situations is morally evaluated.

$\langle w, o, m \rangle \in MR$ with $w \subset \mathcal{B} \cup \mathcal{D}$, $o = \langle a, v \rangle$ with $a \in A$ and $v \in V$, and $m \in \mathcal{O}_m$ is a moral value described in \mathcal{O}_m to qualify o in the state w

Example

- ▶ *Being ecologist is good*
- ▶ *Trade assets of a carbon-neutral energy producer is good*

But Moral values and Moral rules are not enough because an agent may face a choice between both good and bad options (like trolley problem).

Introducing Ethical concerns

Introduction of new concepts

- ▶ **Ethical Principle** : a set of rules describing the rightness of an intention.

Example

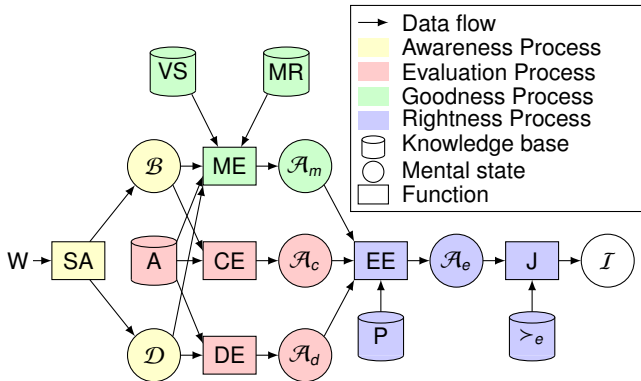
- ▶ P1 : If an action is possible, moral, not immoral and desired, it's a right action.
- ▶ P2 : If an action is possible, not immoral and desired, it's a right action.
- ▶ More complex theories : Thomas Aquinas doctrine of double effect, Aristotelian ethics, ...

Each agent uses a set of ethical principles ordered by preferences to evaluate the rightness of each option.

e.g. : $P1 \succ_e P2$

Introducing Ethical concerns

Ethical Decision Process

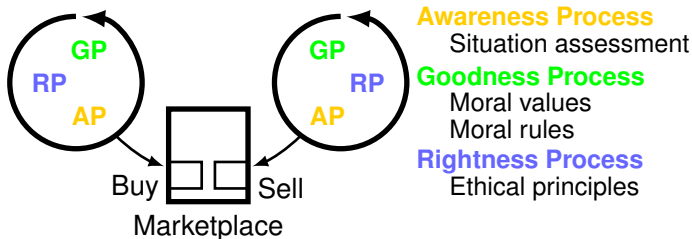


Our proposition of Ethical Decision Process

N. Cointe, G. Bonnet, O. Boissier, *Ethical Judgment of Agents' Behaviors in Multi-Agent Systems*, AAMAS 2016.

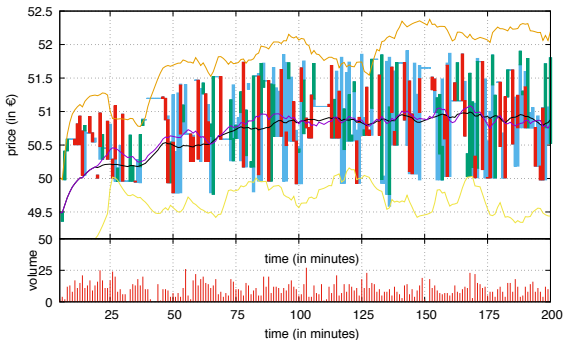
Experiments

Description of the experiments

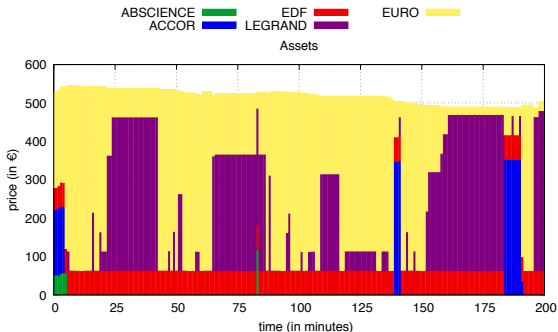


Features

- ▶ Ethical judgment process implemented as a decision process
- ▶ Assets with labels and sector informations
- ▶ A central Limit Order Book embedded in an artifact
- ▶ Pseudo-random portfolio generation
- ▶ Moral rules inspired from www.ethicalconsumer.org



Ethical Asset Managers are able to trade, according to their given ethics and their behavior takes into account moral duties and prohibitions. They use a basic strategy based on moving means and Bollinger bands.



Behavior of an ecologist asset manager

Evolution of the portfolio of an ecologist agent with $P1 \succ_e P2$.
The ecolabel certified company is the preferred one. The

Results

- ▶ A proof of concept implemented in JaCaMo
- ▶ A generic approach easy to configure with new sets of value supports, moral rules and ethical principles
- ▶ This process influences the behavior of the agents according to a given ethics.

Future work

- ▶ Ethical principles need to be more precisely defined in order to capture the various set of theories suggested by philosophers
- ▶ We intend to extend our model to quantitative evaluations in order to assess how far from rightfulness or goodness a behavior is
- ▶ Agents will be able to judge the behavior of the others.

Your suggestions are welcome

Thank you for you attention

"It is based upon extensions to existing deliberative/reactive autonomous robotic architectures, and includes recommendations for [...] behavioral design that incorporates ethical constraints from the onset..."

R. Arkin. *Governing lethal behavior in autonomous robots*. CRC Press, 2009.

Drawbacks

- ▶ No explicit representation of the ethics
- ▶ No genericity
- ▶ The agent cannot distinguish its own ethics from its operational procedures

“A paradigm of case-supported principle-based behavior (CPB) is proposed to help ensure ethical behavior of autonomous machines.”

M. Anderson and S.L. Anderson. Toward ensuring ethical behavior from autonomous systems: a case-supported principle-based paradigm. *Industrial Robot: An International Journal*, 42(4):324–331, 2015.

Benefit

- ▶ Generic approach

Drawbacks

- ▶ No explicit representation of the ethics
- ▶ Classical problems of learning (over-/underfitting) facing new circumstances

“We need other kind of more intricate mental models, able to support moral reasoning capabilities.”

H. Coelho and A.C. da Rocha Costa. On the intelligence of moral agency. Encontro Portugueses de Inteligencia Artificial, pages 12–15, October 2009

Benefit

- ▶ Generic approach
- ▶ Ease interaction between artificial agents and humans
- ▶ Able to infer a behavior in an unexpected situation

Objectives

Define a model of ethical judgment to

- ▶ elaborate it's own rightful behavior
- ▶ judge the others' behaviors

Specificities

- 1 Ethics by reasoning
- 2 We consider only a full rationalist approach (vs intuitionist)
- 3 Morals and ethics are seen as a set of parameters, designed with different approaches and opinions (they are subjective)

