Fully Probabilistic Decision Making at e-Democracy Service

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e-Democracy Research & FP DM

e-Democracy: Complex multiple-participants' DM

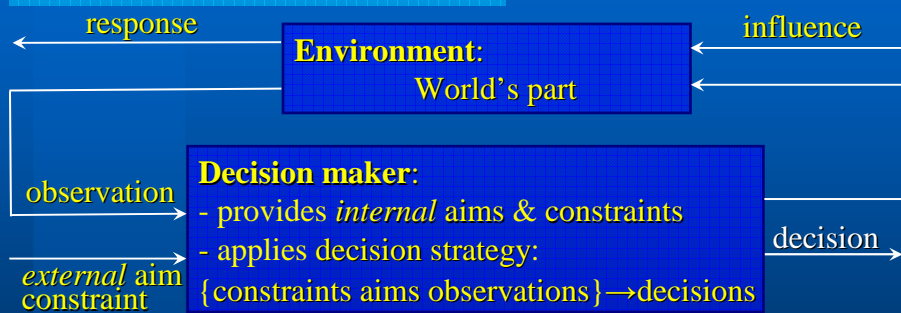Research: Aim of the game, elements, aspects, tools & ways …

Questions: How to make e-D happen? How e-D works? …

How e-D should work ?

FP DM: a prescriptive theory of multiple-participants' dynamic DM
under uncertainty that models even DM aims in probabilistic terms

General Structure of DM

Behavior Q = all considered decisions, influences & responses

Internals = {influence, response}

Prescriptive theory: the best strategy under given circumstances?

Specificity of e-Democracy Domain

• Multiple-participant, multiple-tasks DM

• GDM – "city mayor" with externally given aims & constraints
  - small group
  - *mandatory* care about the discussed DM task
  - allocated resources

  LDM – "citizen" solving many personal DM tasks
  - large group
  - *facultative* care about the discussed DM task
  - limited resources

• DM always has to cope with limited resources, limited abilities, uncertainty, multiple aims, dynamics

Fully Probabilistic Single-Participant DM

Bayesian DM: $\int Z(Q) f(Q) \to$ minimum over causal strategies

$\underbrace{\qquad}_{\text{expected loss}}$

Closed-loop model $f(Q)$ is structured for the causal choice of a *decision*:

$f(Q) = f$ (knowledge, *decision*, ignorance)

$\quad = f$ $\underbrace{\text{(ignorance} \mid decision, \text{knowledge)}}_{\text{learnt environment model}} \times f \underbrace{(decision \mid \text{knowledge)}}_{\text{optimized strategy}}$

FPD $\Leftrightarrow Z(Q) = \ln (f(Q) / {}^I f(Q))$

Ideal model ${}^I f(Q) \Leftrightarrow$ desired closed-loop behavior incl. constraints

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General Structure of DM
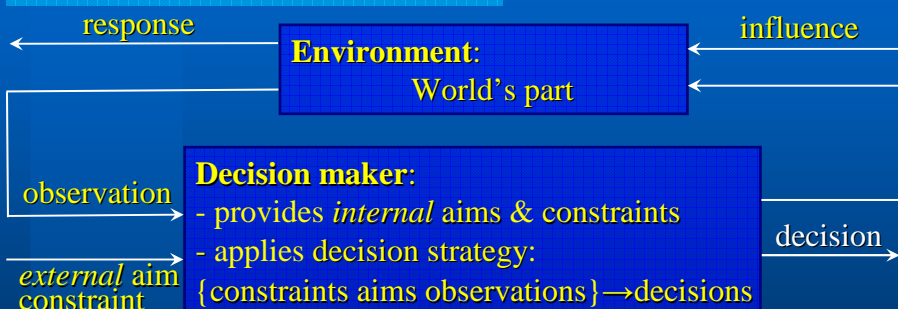
response ← **Environment**: → influence

World's part

observation

Decision maker:
- provides *internal* aims & constraints
- applies decision strategy:

decision

external aim constraint

{constraints aims observations}→decisions

Behavior Q = all considered decisions, influences & responses

Internals = {influence, response}

Prescriptive theory: the best strategy under given circumstances ?

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Properties of Fully Probabilistic DM

Learning

Environment model
theory

Ignorance = internals & future observations
• decision-influenced evolution of internals
• projection of decisions & internals on observations

Knowledge = subjective knowledge & past observations
Pdfs' handling & observation ⇔ estimation of internals & prediction

Design

Support of the ideal pdf $^{I}f(Q)$ = constraints
The support of the optimized closed loop included in the ideal support

Multi-modal ideal pdf = expression of multiple aims
Pdfs' handling & desired behavior ⇔ multiple aims quantified

Fully Probabilistic Multiple-Participant DM

MP DM ⇔ environment of a participant contains other participants

• Application of decisions is the same as in SP DM
• Cooperation is:
- applicable to overlapping parts of behaviors only
- possible only via modification of models & ideals
- realistic if almost no extension of participants' abilities is required
- possible if there is a willingness to share models & ideals

Sharing of knowledge ⇔ modification of pdfs describing internals
The *probabilistic* model of common observations is shared

Sharing of ideals
An auxiliary common ideal is created and projected back

FP Multiple-Participant DM (cont.)

Both sharing operations depend on participant-specific weights that

- reflect fidelity into the shared knowledge
- relative significance of other participant's aims

⇩

Cooperation scenarios

- selfish ⇔ each participant selects its weight
- democratic ⇔ weights harmonized … negotiation!
- autocratic ⇔ weights enforced

FP DM: GDM Perspective

Multiple aims inherent: external ⇔ care about city
internal ⇔ care about himself ⟹
The need to model LDMs internals, e.g. degree of satisfaction

Induced DM: building & stimulating efficient two-way
communication channels to multitude overloaded LDMs
Understood in marketing, still underestimated in politics

Scenarios
- selfish prevented by competitive GDMs & LDMs' mass
- autocratic endangered by Chinese whispering effect
- democratic, probably the only stable one, but requires
additional DMs … negotiation, inspection of LDMs aims

Multi-modality & dynamics are un-avoidable

FP DM: LDM Perspective

Ignoring can be dangerous, thus there is a need for

- awareness of the game ⇔ elementary education
- personal focus on important aspects ⇔ modeling & filtering
- multiple sources of information
- reliable multi-channel information transfer
- objective, easy-to-handle evaluation tools a' la mortgage calculators

Is the single LDM too weak ?

- law of large numbers works
- joining an interest groups (parties) but fractals effect

FP DM: Research Perspective

FP DM

- provides a consistent view on MP DM faced by e-democracy
- unifies models of environment, aims & constraints
- treats multiple aims consistently
- respects limited capacity of the involved information channels
- provides formal co-operation & negotiation tools
- explains limited response rate of LDMs
- classifies co-operation scenarios

… provides a promising & interesting framework for a systematic development of toolset supporting democratic processes at all levels

THE END