Rational abstract search
(Outline)

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I. Introduction.

A. Structure of this paper.

II. Planning and game-playing.

A. A general view of planning.

B. Games as domains for planning.

C. Unrealized potential of game-playing.

III. Restrictiveness of current CGP methods.

A. State-transition ontology.

1. Naturalness of STO.
2. Consequences of STO.
   a) Ignoring important properties.
   b) Focus on state-search algorithms.

B. Inappropriatenesses of state-search algorithms.

1. Hidden information.
2. Gradual change.
3. Large branching factors.

C. Need for abstractions.

IV. Abstraction in game-playing and planning.

A. Abstraction exists already.

1. Ignoring time/history/mental-state.
2. State classification in evaluation functions.
3. Node as an abstraction of histories.

B. Proposed additional useful kinds of abstractions.

1. Over states/state-sequences/state-transitions.
2. High-level actions.
3. Island subgoaling.

V. A unifying view of abstraction.

A. Inadequacy of abstract states.

B. Alternative: abstractions of state-histories.

1. Definitions: abstraction, satisfaction, abstraction-propositions.

C. Representing various kinds of abstractions under this framework.

1. Node in a game-position graph.
2. Node in a game-position tree.
3. Evaluation-function classes.
4. Abstracting over states.
5. High-level actions.
6. Island subgoals.
7. Partial moves.
8. Representing additional properties.

VI. Methodology for studying abstract reasoning.

A. Translating existing methods into abstraction framework.

1. Partial graph search.
2. Propagating information from graph fringe.
3. Refining plans.

B. Use of probability and decision theory.

1. Inducing from the general to the specific.
2. Deducing from the specific to the general.
3. Search control.

VII. Probabilities and utilities of abstractions.

A. Similar problem: logic of preference.

1. Possible-worlds definition.

B. Utility from utilities of world-histories.

1. Dependencies problem.
2. World-histories with probabilities.

C. Definitions

1. Probability of an abstraction.
2. Utility of an abstraction.

VIII. Abstraction networks.

- **A. Translations of game-graphs.**
- **B. Game-tree nodes as state-sequences.**
- **C. Example of translating a game-tree.**

IX. Conclusion—state of work in progress.

- **A. Propagation algorithms.**
- **B. Implementation for spider solitaire.**
- **C. Future issues.**