Multiagent Flight Control and Virtual Navigation

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Introduction

Multiagent visual computing techniques are applied to design autonomous flight control and spacecraft navigation. The basic technique introduced in (Nourani1995) is that of viewing the world as many possible worlds with agents at each world that compliment one another in problem solving by cooperating. The double vision computing paradigm with objects and agents might be depicted by the following figure. The cooperative problem solving paradigms have been applied ever since the AI methods put forth by Hays-Roth. However, the muliagent multi-board techniques due to the author (Nourani1995). The techniques to be presented are to be applied to Mobile Multimedia. Communication and computation by multimedia visual-object languages can be programmed with IM with a simple syntax. The techniques to be presented are to be applied for (a) Precomputed video-object composition and combination for spatial morph Gentzen computing with visual objects (b) High speed visual spacecraft navigation with multiagent multimedia.

The Morph Gentzen Computing Logic for computing for multimedia is new projects with important computing applications since (Genesereth & Nilsson 1987) The basic principles are a mathematical logic where a Gentzen (Gentzen et al.1943) or natural deduction systems are defined by taking arbitrary structures and multimedia objects coded by diagram functions. Multimedia objects are viewed as syntactic objects defined by functions, to which the deductive system is applied. The deduction rules are a Gentzen system augmented by Morphing, and Transmorphing on events {p1,p2,...,pn} with a consequent hybrid picture p. Thus the combination is an impetus event. The deductive theory is a Gentzen system in which hybrid pictures are named by parameterized functions; augmented with the morph rules. A soundness and completeness theorem has been put forth in the author's papers on Morph Gentzen, which is applied to visual multiagent flight control and planning.

Multiagent Planning

The visual field is represented by visual objects connected with agents carrying information amongst objects about the field, and carried onto intelligent trees for computation. Intelligent trees compute the spatial field information with the diagram functions. The trees defined have function names corresponding to computing agents. The computing agent functions have a specified module defining their functionality. Multiagent spatial vision techniques are introduced in the author's papers (Nourani 1999) The muliagent multi-board techniques due to Nourani (Nourani 1993) The BID Breizier-Treure et.al. (Brazier edt al. 1997) model has to be enhanced to be applicable to intelligent multimedia. Let us start with an example multi-board model where there multiagnt computations based on many boards, where the boards corresponds to either virtual possible worlds or to alternate visual views to the world, or to the knowledge and active databases. The board notion is a generalization of the Blackboard problem-solving model since Hayes-Roth. The blackboard model consists of a global database called the blackboard and logically independent sources of knowledge called the knowledge sources. The knowledge sources respond opportunistically to the changes on the blackboard. Starting with a problem the blackboard model provides enough guidelines for sketching a solution. Agents can cooperate on a board with very specific engagement rules not to tangle the board or the agents. The multiagent multi-board model, henceforth abbreviates as MB, is a virtual platform to an intelligent multimedia BID agent-computing model. We are faced with designing a system consisting of the pair <IM-BID,MB>, where IM-BID is a multiagent multimedia computing paradigm where the agents are based on the BID model. The agents with motivational attitudes model is based on some of the assumptions described as follows. Agents are assumed to have the extra property of rationality: they must be able to generate goals and act rationally to achieve them, namely planning, replanting, and plan execution. Moreover, an agent's activities are described using mentalists notions usually applied to humans. To start with the way the mentalists attitudes are modulated is not attained by the BID model. It takes the structural IM-BID to start it. The preceding chapters and sections on visual context and epidemics have brought forth the difficulties in tackling the area with a simple agent computing model. The BID model does not imply that computer systems are believed to actually "have" beliefs and intentions, but that these notions are believed to be useful in modeling and specifying the behavior required to build effective multi-agent systems. The first BID assumption is that motivational attitudes, such as beliefs, desires, intentions and commitments are defined as reflective statements about the agent itself and about the agent in relation to other agents and the world. These reflective statements are modeled in DESIRE (Brazier et al. 1997) in a meta-language, which is order sorted predicate logic. At BID the functional or logical relations between motivational attitudes and between motivational attitudes and informational attitudes are expressed as meta-knowledge, which may be used to perform meta-reasoning resulting in further conclusions about motivational attitudes. If we were to plan with BID with intelligent multimedia the logical relations might have to be amongst worlds forming the attitudes and event combinations. For example, in a simple instantiation of the BID model, beliefs can be inferred from meta-knowledge that any observed fact is a believed fact and that any fact communicated by a trustworthy agent is a believed fact. With IM_BID, the observed facts are believed facts only when a conjunction of certain worlds views and evens are in effect and physically logically visible to the windows in effect. Since planning with IM_BID is at times with the window visible agent groups, communicating, as two androids might, with facial gestures, for example Picard (Picard 1999a) In virtual or the "real-world" AI epistemics, we have to note what the positivists had told us some years ago: the apparent necessary facts might be only tautologies and might not amount to anything to the point at the specifics. A BID assumption is that information is classified according to its source: internal information, observation, communication, deduction, assumption making. Information is explicitly labeled with these sources. Both informational attitudes (such as beliefs) and motivational attitudes (such as desires) depend on these sources of information. Explicit representations of the dependencies between attitudes and their sources are used when update or revision is required. A third assumption is that the dynamics of the processes involved are explicitly modeled. A fourth assumption is that the model presented below is generic, in the sense that the explicit meta-knowledge required to reason about motivational and informational attitudes has been left unspecified. To get specific models to a given application this knowledge has to be added. A fifth assumption is that intentions and commitments are defined with respect to both goals and plans. An agent accepts commitments towards himself as well as towards others (social commitments). For example, a model might be defined where an agent determines which goals it intends to fulfill, and commits to a selected subset of these goals. Similarly, an agent can determine which plans it intends to perform, and commits to a selected subset of these plans. Most reasoning about beliefs, desires, and intentions can be modeled as an essential part of the reasoning an agent needs to perform to control its own processes. The task of belief determination requires explicit meta-reasoning to generate beliefs. Desire determination: Desires can refer to a (desired) state of affairs in the world (and the other agents), but also to (desired) actions to be performed. Intention and commitment determination: Intended and committed goals and plans are determined by the component intention_and_commitment_determination. This component is decomposed into goal_determination and plan_determination. Each of these subcomponents first determines the intended goals and/or plans it wishes to pursue before committing to a specific goal and/or plan. Since the basic IM computing visual objects are hybrid pictures we define new planning techniques with hybrid pictures. The IM planning does not only applies planning with agents, it applies Morph Gentzen rules to hybrid pictures to achieve plan goals. The hybrid pictures carryout responsive, proactive, and reactive planning, only initiated and directed by a planning system. An example IM planning mission is as follows:

Hybrid picture 1 Spacecraft A Navigation Window

Agents: A1 Computes available docking times based on the visual field on the window.

A2 carrys out docking sequence based on me s-sages to Spacecraft B

Hybrid picture 2 Spacecraft B Navigation Window

Agents: B1 carries on course based on its visual field window

B2 Accepts and carries out docking maneuvers from external hovering craft agents

Plan Goal Engage docking between A and B at appropriate A and B field windows.

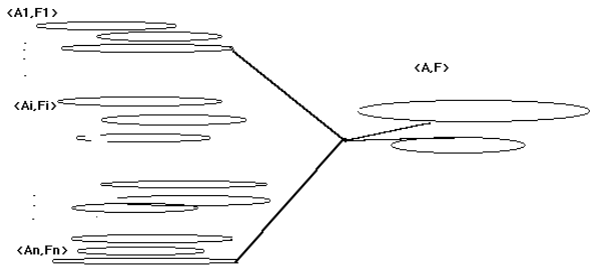
Morph Gentzen computing can be applied to the hybrid pictures to satisfy a plan goal. Thus morphing is applied with precise fluidity to plan computation.

Proposition Morph Gentzen and Intelligent languages provide a sound and complete logical basis to VR.

A Multiagent Navigator

The autonomous space vehicles, e.g. Mars Rovers, are example areas where we have provided applications for spatial agent computing. Space examples are areas where there are specific terrains precomputed for missions. For such environments Morph Getnzen Spatial Logic can be designed to carry out autonomous intelligent multimedia activities. Morph Gentzen terrain logic is designed where a combinations known terrain events vision sensed trigger a specific autonomous activity by a Mars Rover in real-time. The microrover technology has several limitations precluding more ambitious science-rich missions. Onboard machine intelligence provides capabilities for autonomous search and recognition of potentially interesting targets, as well as capabilities for sensor platform planning and utilization. Morph Getnzen terrain logic can be applied to enhance autonomous traversal and autonomous multimedia search.

The Autonomous Enterprise



The designs state all exceptions to actions and what recovery and corrective actions are to be carried out. For each action on an object a dual action is to be supplied such that a specifier can fully define the effect of the dual actions. As an illustration the following trivial example defines part of a flight system's operations. Object:= Enterprise_Flight_Computer; Set module at Locations Scanned by the Virtual_Moveer scanning device; Energise; Exp:=OPS:= Virtual_Move (Source,Destination,Object)| ......; EVirtual_Move (Source,Destination,Object) |...;

Virtual_Move (Mars,Enterprise, Module) => Signal an available Mars_Rover robot to Fetch Module from <stored_location, module number>; EVirtual_Move(Mars, Enterprise,Module) => If Mars Rover robot signals that Module is locked or too heavy for robot to move to Virtual_Moveable points, Activate_Multiple_Robots to cooperate, unlock and move module to Virtual_Move point.

An example model diagram function is Virtual_Move. A Morph Gentzen design might be applied to precomoputed terrain multimedia chips. The pi's are processes. Semicolon represents processes sequencing. For example, p1;p2 represents processes p1 and p2 running sequentially,p1 followed by p2. Each of the message syntactic categories can be defined in very simple terms to suit the particular intended application areas. In addition, the specification language is extendible as far as the type of communication it allows the processes and the nature of parallelism. The process bodies can be specified in terms of the actions they are intended to perform and the messages they send.

<module> := {p1;p2;...;pn} || {q1;q2;...;qn} || <module> || <{pi}>

Developing robotic rovers for planetary surface exploration are areas where multiagent Morph Gentzen multimedia planning might be applied.

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