An Intelligent Agent Based on Virtual Geographic Environment System

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ABSTRACT  On the basis of previous work, this paper designs an intelligent agent based on virtual geographic environment (VGE) system that is characterized by huge data, rapid computation, multi-user, multi-thread and intelligence and issues challenges to traditional GIS models and algorithms. The new advances in software and hardware technology lay a reliable basis for system design, development and application.

KEYWORDS  virtual geographic environment; intelligent agent; system design

Introduction

Virtual geographic environment (VGE) refers to environments concerning the relationship between post-humans and 3D virtual worlds. It sends challenges to traditional GIS models and algorithms because they hardly meet the present requirements.

A software agent is the broker for users. It can perform work for users as directed. From the respect of system, an agent is a software object that is situated within a working environment and processes the mandatory agent properties. Intelligent agents are agents with artificial intelligence. Their main functions are described as follows:

- collecting data from numerous places;
- searching and filtering information;
- monitoring;
- target information dissemination;
- agent-to-agent negotiation;
- parallel computations;
- barter;
- enhance telecommunication network services;
- controlling smart matter;
- enhance entertainment.

The above techniques have been successfully applied in many fields of geography, such as:

- urban environment; pedestrian flow, vehicle flow, real estate-houses for sale; urban land use changes; virtual city design;
- country environment; village formation;
- natural disasters; influence of hurricane on local environment;
- information processing; geographic information management/searches; spatial analysis, spatial reasoning; spatial decision support system; mapping.

Many implementations prove that spatio-temporal changes of a complex system can be simulated through agent-to-agent interactions. A VGE system is obviously a complex system and its key technical requirements can be satisfied if intelligent agents are introduced. Therefore, an intelligent agent based VGE system is designed in this paper.
1 System design

1.1 Structure of the system

The structure of the VGE system is illustrated in Fig. 1.

Client/Server structure is used in the system design. On the server side, there are two kinds of servers—database server and application server, and application server is further divided into VGE news server, virtual sale server, information filtration server, visual data mining server, intelligent modeling server, data and model precision check server, network security server, agent registration and dynamics management server, simulation and virtual reality server, public decision-making server, and client assistant server. On the client side, it contains 3D virtual world browser and applications, and the applications are further divided into 12 modules shown in Fig. 2.

1.2 Modules of the system

Functions of each module are described as follows.

1) VGE news agent: search information of conferences, news and papers related to VGE on the internet, store it in the database, notify clients and update the information regularly;

2) virtual sale agent: buy/sale data and application on the web, creating scene for negotiation and scheduling the process of negotiation;

3) information filtration agent: browse, filter and store data/application according to key words input by clients. According to client browsing frequency and assessment to the filtering results, learning algorithms are used to strengthen searching algorithms;

4) visual data mining agent: linking databases to the application for visualization, data mining and learning algorithms based on database, model base, rule base and Clients’ feedback are used;

5) intelligent modeling agent: on the basis of database, model base and rule base modeling step by step;

6) data and model precision check agent: check the precision of data and models; mark data/models with precision and notify clients for further updating or improving modeling algorithms;

7) network security agent: anti-virus, access control and file status monitoring;

8) agent registration and dynamics management agent: user’s name, password and status input and management; provide a text box for users’ communication;

9) simulation and virtual reality agent: avatar animation; scene description, simplification and design; parallel computation; perception genera-