Mars Information Access Server

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Motivation: We build technologies to address problems with finding information online (see other abstracts in this collection) and have applied these technologies to a variety of data sources on the World Wide Web. One such application is space exploration. NASA’s Jet Propulsion Laboratory has an interest in providing convenient public access to information on their Web site about Mars and missions to Mars, primarily to further science education. Their data access needs serve as an excellent test bed for our technologies, and our technologies can help them fulfill their data access needs.

Previous Work: Our goal is to build, in association with JPL, an information access server which will answer user questions related to Mars and Mars exploration, focusing on the launches and landings of the Mars Exploration Rovers (MER). As our first step toward this goal, we created an information server which answers individual queries regarding background information on Mars and on exploration of Mars.

Approach: JPL’s data presented an interesting mix of structured, semi-structured, and unstructured data. Different components of the START system were brought to bear to handle different types of data. Structured data, such as the Mars Atlas and JPL’s index of solar system exploration missions, was made available through parameterized annotations [4, 1, 3]; see Figure 1. Using this data, we can answer queries such as “what are the goals of Mars Global Surveyor,” “when was Mariner 4 launched,” “where did Amazonis Planitia’s name come from,” “what is a chasma,” “show me the Mars Pathfinder rover,” “list some Martian mountains,” etc. Semi-structured data such as Mars Team Online was handled by our Sapere information retrieval system [2]. Mars Team Online is a large collection of explanations provided by JPL researchers in response to public queries. Each explanation is labeled with a short phrase or sentence which describes it. Since these descriptions were already available, we were able to treat them as automatically derived annotations, and parse and index them with Sapere. Unstructured data such as Mars mission data was added to the system using individual annotations, as well as through properties—such as locations of photographs—associated with lexical items [4]; this allows us to answer queries such as “what is the current position of the Mars Odyssey,” “what goals does NASA hope to accomplish on Mars,” “what missions have we sent to Mars,” “show me a picture of a human face on Mars.”

Impact: At the annual JPL open house in 2001, our Mars server (see Figure 2) was unveiled to the public. Attendees of the open house, especially children, enjoyed the server immensely. The URL was made available, and members of the public have continued to query the server. [5]

The Mars server has successfully exercised all the technologies of the START system and demonstrated their value for realistic access to heterogeneous information.

Future work: Answering questions about the MER will provide a new challenge: it will be necessary to integrate data into the system as it is acquired and sent home by the mission rover. It will, of course, be necessary to acquire new values for predefined objects and attributes, for example, a new picture of a previously named surface feature, or soil composition for a location whose analysis was planned. Provided data is made available to our system in a predefined structured format, our system will automatically gain access to it as it appears, but if data is unstructured, then it will be necessary to add annotations on the fly. Going beyond that, it will probably be necessary to acquire new objects (e.g., newly named locations on the surface of Mars) and new attributes (relating to types of data whose acquisition was not predicted in advance). While objects and attributes can easily be added to the system, we will also have to add annotations to map between language and the new attributes. We will develop methods to speed creation of annotations in order to facilitate this process.
Figure 1: Information about a Martian surface feature retrieved from a JPL database.

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References:


