

Astronomy News Element Analysis and Visualization System for the web

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Abstract—We investigated online astronomy news, exploited the individual space concept, and developed a news timeline to construct an interactive astronomy visualization system that integrates time and spatial concepts. Before constructing our system, we referred to the essential factor of astronomy news display modes and chose well-known astronomy websites as the survey objects. We investigated news interfaces and determined their interactive problems. (*Abstract*)

Keywords—astronomy; visualization system; interaction (*key words*)

I. Introduction

Online news is immediate, offers easy global interaction, and has already become an important communication media. News continues to increase every day, and astronomy news data resemble an enormous archive. Users of news websites or browsing systems require a mature function to obtain news smoothly and simply. To design a system that conforms to astronomy news visualization interfaces, we exploit the concept of the universe's astronomy objects by digitizing astronomy news displays by year and month; since application interfaces are different from standard astronomy websites, display inconvenience must be improved and problems solved. Before designing our system, this research addresses astronomy news and surveys some well-known global astronomy news websites and analyzes their characteristics to anticipate problems.

II. Astronomy website

We divide existing astronomy websites into the following: (1) general astronomy websites, (2)

astronomy institution websites, and (3) astronomy magazine websites. General astronomy websites mainly introduce astronomy knowledge and new information; astronomy institution websites mostly show research results or related messages. For example, NASA always takes down new discoveries on a regular time schedule. Astronomy magazine websites introduce technology or information for activities all over the world.

2.1. Elements of astronomy websites

Since all three kinds of websites have functions for astronomy news, we include them in our research target and conduct a survey of their application modes. To precisely determine the news elements of astronomy websites, we categorize them into: (A) astronomy website top pages, (B) news title linking pages, and (C) news writing pages (Fig.1).



Fig. 1 Three kind of pages in astronomy websites

2.1.1. Astronomy website top pages

We set the astronomy top pages as follows: News column, RSS, Education, and Searching for items. News column means that we can directly read the news title on the top pages. The Really Simple Syndication (RSS) function is a family of Web feed formats used to publish frequently updated news. The education function assists astronomy knowledge such as starry sky guidance. To get astronomy information easier, a convenient searching function is necessary for astronomy sites.

TABLE 1 Main news element for top pages

Function	Astronomy website top pages					
	General websites		Institution websites		Magazine websites	
English	9		6		3	
Chinese	3		1			
Japanese	3				1	
French	1					
News column	8	50%	7	100%	4	100%
RSS	8	50%	3	43%	2	50%
Education	15	94%	6	86%	3	75%
Searching	15	94%	6	86%	4	100%

We compared general astronomy homepages and found that almost 90% simultaneously offer functions that assist searching and education. Users receive help not only reading news but also getting other information from astronomical websites about constellations or eclipse navigators. This is especially obvious in astronomy institution and magazine websites. In recent years, reflecting the increased popularity of online news, nearly 50% of astronomy websites have added RSS functions (Table 1).

2.1.2. News title linking page

In the news title linking page, we set five items: 「Classification」, 「News date」, 「News title」, 「Photo」, and 「Abstract」. Regarding the linking pages, we classified astronomy news based on news that occurred a year or a month ago by different time links. Some are classified by astronomical object name, taking such astronomy objects as Mars or Jupiter as the subject, or by different astronomical objects to help users distinguish key subjects. In over 90% of astronomy websites, the link function of news is indicated by news titles and times. This is the most popular way for news websites to show messages; users read the title or date and choose what they want to read. About 40% of the websites use news abstracts and photos to explain the news title. (Table 2)

TABLE 2 Main news element for linking pages

Function	News title linking pages					
	General websites		Institution websites		Magazine websites	
Classification	10	63%	5	71%	2	50%
News date	14	88%	7	100%	3	75%
News title	16	100%	7	100%	4	100%
Photo	4	25%	4	57%	2	40%
Abstract	5	31%	5	71%	2	50%

2.1.3. News writing page

In the news writing page, we set the following five items: 「Classification」, 「Photo」, 「keyword」, 「Reference」 and 「Relation news」. Among the statistical objects, only four websites supply news titles to links to exterior websites. On the other side, the function of related news means that the websites of astronomy magazines or institutions show recent news about astronomy research or developing technology, so users access hyper links to immediately read the original news websites.

TABLE 3 Main news element for writing pages

Function	News writing page					
	General websites		Institution websites		Magazine websites	
	Outside links: 3				Outside links: 1	
Classification	5	38%	4	57%	0	0%
Photo	10	77%	3	43%	3	100%
Keyword	7	54%	0	0%	2	67%
Reference	9	69%	6	86%	2	67%
Related news	8	62%	5	71%	1	33%

For the content of news writing pages, since some news is reprinted from other astronomy websites, nearly 70% of websites directly indicate the source or the author and supply links to the original news websites. Nearly 40% of astronomy websites consider proper nouns of the news and supply keywords for user convenience. (Table 3)

2.2. Advantages and disadvantages

After reorganizing 27 astronomy websites, we are in view of the news applications, the following advantages and disadvantages can be shown.

Advantage: Auxiliary functions for keyword and classification are good for reading and getting astronomy knowledge. Astronomy news is more complicated than other kinds of news. Therefore partial astronomy websites and news articles commonly provide keywords and search functions that show the probability of astronomical proper nouns.

Disadvantage: Since controlling the kind of news in websites is difficult, users waste a lot of time choosing and reading. Most astronomy websites display all news titles on the same page. Users click on the news titles to be linked to the full text. For such applications, if users only want to learn about one kind of astronomy object news, they still have to read all the titles before choosing. Controlling the kind of news in websites is difficult, so users waste a lot of time. Since the massive amount of news and records is mixed up on the same news pages, the target news cannot be easily found. If we view the same news subjects, understanding the correlation is hard; on websites such applications are confusing.

III. Related works

For visualization systems, some researchers use the points of keywords, time, and 3D space to display visualization interfaces. For example, Nomata [1] proposed a novel visualization system for news articles that supports the exploring, the observation, and the supplying of visual summaries of news articles. Matsumoto [2] proposed a multi-channel dissemination system with a time dependent filter and an application technique for time-series documents on the Internet. He also took a push-based application method based on confidence and scoop levels to describe a prototype system.

Another case concerns Google Earth, which allows users to travel anywhere on Earth to view satellite imagery, maps, terrain, 3D buildings, and even galaxies in space. Users can explore rich geographical content, save places they've toured, and share them with others. By these researches we can specifically take the news changes, the news recording times, the news title keywords, and 3D space performances for astronomy; they are all extremely suitable, advantageous tools that can be displayed as visualization news interfaces.

IV. Astronomy news visualization system

After analyzing the news page applications of existing astronomy websites, we identified four basic projects of astronomy news content: 「Time」 「Position」 「Content」 and 「Auxiliary」. These items are also precisely regarded as the news basis classifications for related works (Fig. 2). Therefore this research enhances these elements and strengthens the value for astronomy news. We also integrate several dynamic interfaces so that the application of astronomy news is more systematic and organized.

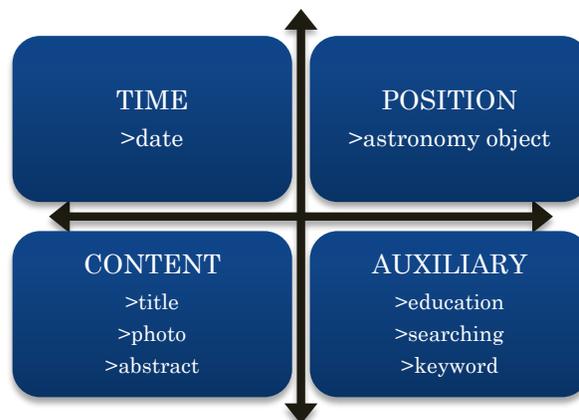


Fig. 2 Four main elements for astronomy news

Some classifications are by year and month, using an interface that combines the universe elements for time and position functions. Before constructing our system, we cooperated with the astronomy researchers from the Nagoya Science Museum, who classified and analyzed all the astronomy news data in website 「AstroArts」 (<http://www.astroarts.co.jp/index-j.html>), using the news content of each astronomical object as the basic data.

4.1. Characteristic of 3D space

To strengthen how users remember news, we emphasize the position of the astronomy object in the news by enhancing the impression of the vision to encourage interest in correlation news for users. This system utilizes news elements for the position of astronomical objects in the universe and concretely displays astronomy news or other information about them. When users read the news, they can directly realize the distribution of the entire galaxy. News browsing interfaces require a scene of 3D space. 10 m is the basic unit to compute the distance of the universe (Fig. 3). We use 10-m units to advance from the earth to the universe. From 10^7 (m) to 10^{27} (m) by 3D animation, we can take the scene from zoom in to zoom out to display the position of each astronomical object as well as the universe space.

4.2. Time relation characteristics

With the time series as a foundation, we can build a time relation and an evolution list for news. The time at which the news occurred is our foundation, and by the visualization time bar with dynamic performance, we supply support to understand astronomy developments. Users can determine the records of the changes of astronomical objects or what happened to the development of astronomy research based on the

news timeline. This system will assist users who read news and will also significantly help them remember the news better. In accordance with the occurred time, users may also obtain sub-time areas for related information by purchasing astronomy research, which is the focus for each research institution each year.

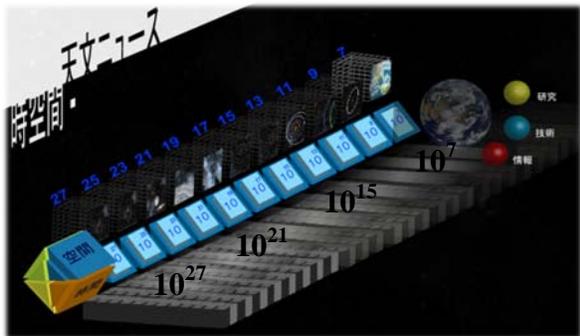


Fig. 3 Object distance for power of ten

4.3. Classification and auxiliary

Using the interactive animation menu, we display astronomy knowledge in this system that is being diversified. By developing a set of news visualization systems to which the concept of the time and space of the universe is applied, users can exploit astronomy proper nouns or astronomy photos to get astronomy knowledge. We desire a system that has both entertainment and education functions and subjects for astronomy news edutainment. We want to use different groups of astronomical objects to explain astronomy news by classifying astronomy objects, education, and searching auxiliaries.

V. Conclusion

This research surveyed some well-known global astronomy news websites and analyzed their characteristics and problems. We identified four basic astronomy news projects: time, position, content, and auxiliary; these items are also precisely regarded as an important basis of news classification for related works. To strengthen the application of astronomy news, our system displays concrete space and a time menu to simplify news classification. We use an interactive animation menu to enhance the concept of the universe and to help users discover news about it. We also offer diverse search functions to increase reading convenience.

Following the progress of astronomical observation technology, users can obtain astronomy knowledge more rapidly and effectively. In our system we set

knowledge searching and astronomy learning functions so that users can immediately absorb astronomy knowledge. Our interactive astronomy learning system explains or annotates proper nouns to simplify the explanations of special astronomy knowledge to enhance user interest in astronomy news.

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