

Design of Intelligent Interface for Document Understanding

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Abstract

The paper deals with the design of Intelligent Interface for Document Understanding (IIDU). Document Understanding is an important aspect of Web-based Information Retrieval. It is a process of extracting useful information from the document such as text file, PDF file and web page. Intelligent interface is an AI program which acts as an interface between human and computer. Intelligent Interface helps user to understand web documents semantically and delivering useful information to the users, which results in enhancing utilization of e-resources.

1. Introduction

Computer programs are permeating through human's daily life, from commercial application to scientific research, from education to entertainment. People are increasingly accustomed to have resource to computer programs to do the computations, to search needed information and even to make decisions. Therefore, an obliging and clever interface will greatly reduce user's work and increase the efficiency of the computer programs.

1.2 Intelligent Interfaces

Intelligent interface agents are computer programs that employ artificial intelligence techniques in order to provide assistance to a user dealing with a particular computer application. Interface agent must have some kind of intelligence, such as knowledge acquisition, autonomy and collaboration. Recently, many researchers are devoting themselves to design and realize various interface agents applied to various domains.

The architecture of intelligent interface includes rules, frame descriptors, discrimination networks, inference engine, associative memory, matching and autonomous agents. Intelligent interface for HCI systems can be present in two forms such as natural language interface and graphical interface.

Intelligent interface can adapt to the needs of different users, it can learn new concepts and techniques, it can anticipate the needs of the users, it can take initiative and make suggestions to the users, and it can provide explanation of its actions.. Typically, we require of an intelligent interface that it should employ some kind of intelligent technique. What exactly, counts as an intelligent technique will vary over time, but the following list is a fairly complete lists of the kinds of techniques that today are being employed in intelligent interfaces:

- *User Adaptivity* : Techniques that allow user-system interactions to be adapted to different users and different usage situations.
- *User Modeling* : Techniques that allow a system to maintain knowledge about a user.
- *Natural Language Technology* : Techniques that allow a system to interpret or generate natural language utterances, in text or in speech.
- *Dialogue Modeling* : Techniques that allows a system to maintain a natural language dialogue with the user, possible in combination with other interactions mean (multimodal dialogue).
- *Explanation Generation*: Technique that allow a system to explain its results to a user.

Intelligent user interfaces have been proposed as a means to overcome some of the problems that direct manipulation interfaces cannot handle, such as information overflow problems; providing help as how to use complex systems; or real time problems. Intelligent user interface is also being proposed as a means to make systems individualized or personalized.

Interface agents are the prevailing development towards intelligent user interfaces.

An intelligent interface cooperates with the user in performing its tasks, working as a personal user assistant. The interface agent is pro-active taking the initiative and not passive. Usually, an intelligent interface is not the interface between the user and the application. Instead, it observes the interactions between the user and the program learns with it and interacts both with user and program.

1.2 Document Understanding

Document analysis starts with the document image and ends with its complete logical structure. For this purpose two main steps are needed : one to extract the layout structure, called the *layout detection*; and another one to determine the logical structure, called *document understanding*.

As document authoring is a non-reversible process, document knowledge is essential in the document analysis process. The document knowledge is mainly used in document understanding. There are two main phases in document understanding. In the first phase, the layout document objects are grouped and classified as logical objects. Then, among logical document objects, logical relations are determined [1].

Digital document libraries have become an increasingly important means of storing information within organizations. Automatic understanding of documents will certainly improve the utilization of e-resources among the potential users.

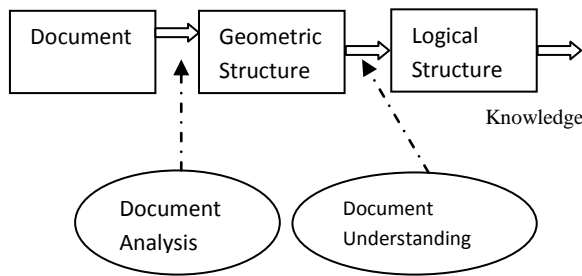


Fig 1: Document Understanding

2. Related Work

Many researchers are conducting research in the field of Intelligent Interfaces. Intelligent Interfaces can be employed in various applications such as An Intelligent Interface for a Housekeeping Robot, Ubiquitous e-Learning, Intelligent Interface Agent for Web-based Information Retrieval (DOLTRIA_IA), Distributed Intrusion Detection with Intelligent Network Interfaces for Future Networks, An Adaptive Visual Gesture Based Interface for Human Machine Interaction in Intelligent Workspaces, Intelligent Camera Interface (ICI): A Challenging HMI for Disabled People, An Intelligent Brain Computer Interface of Visual Evoked Potential EEG (BCI).

Some of the Intelligent Interfaces, mentioned above have been studied and analyzed on the basis of some parameters. The comparison is given in Table 1. It reveals that Intelligent Interfaces can be made more effective if they can provide good user modeling, user adaptively, natural language interface, dialogue modeling and explanation generation. This gives me motivation for conducting research on Intelligent Interface for Document Understanding.

Table 1: Comparison of various Intelligent Interfaces

Intelligent Interfaces	User Adaptivity	User Modeling	Natural Language Technology	Dialogue Modeling	Explanation Generation
MCE	X	X	√	√	X
UeL	X	X	√	√	X
NLPW	X	√	√	√	√
IIHR	X	X	√	√	X
ICI	√	√	√	X	X
PDI	X	X	X	X	√
VOR	√	X	√	X	√
PCE	√	√	√	X	√

2. Objectives

- Planned approach towards analysing document
- Easy reading by highlighting important words
- Separating images from text in the document
- PDF file editing
- Providing Holistic view of document

3. Proposed Work

We propose to built an interface which will analyse not only text files but also different types of documents for example word, PDF files etc. The analysing of documents would be based on nouns and adjectives occurring in the document. The nouns and adjectives would be highlighted in different colours. Apart from this, we also decided to highlight keywords, inbuilt methods, classes in a java file. The main aim of this project Intelligent Interface for Document Understanding is to get complete view of the document without reading it.

4. Intelligent Interface Design

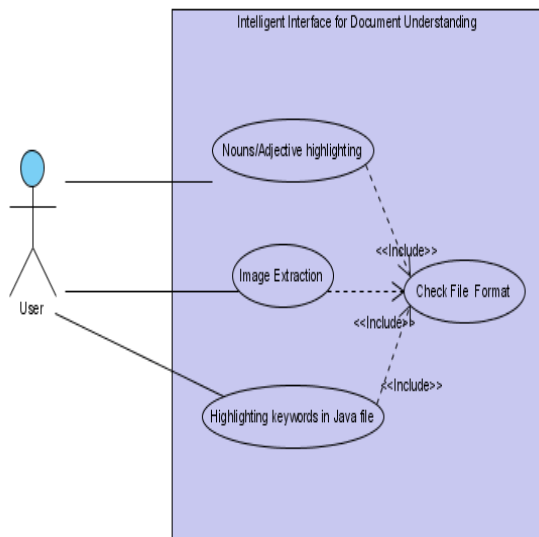


Fig 2 : Use case diagram for IIDU

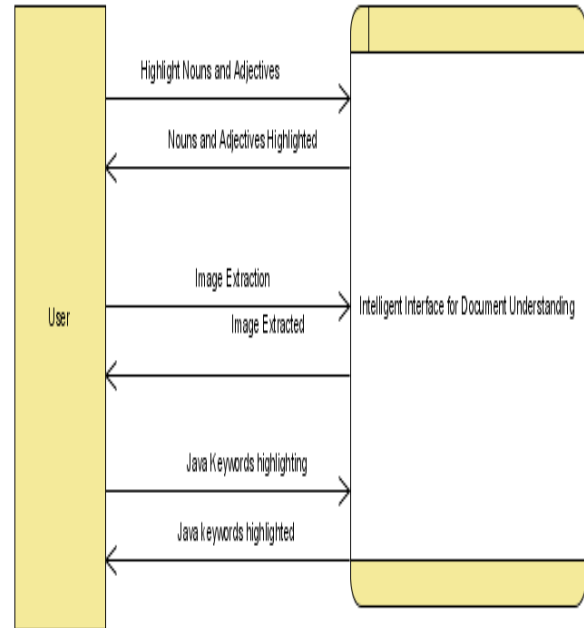


Fig 3: DFD (Level 0)

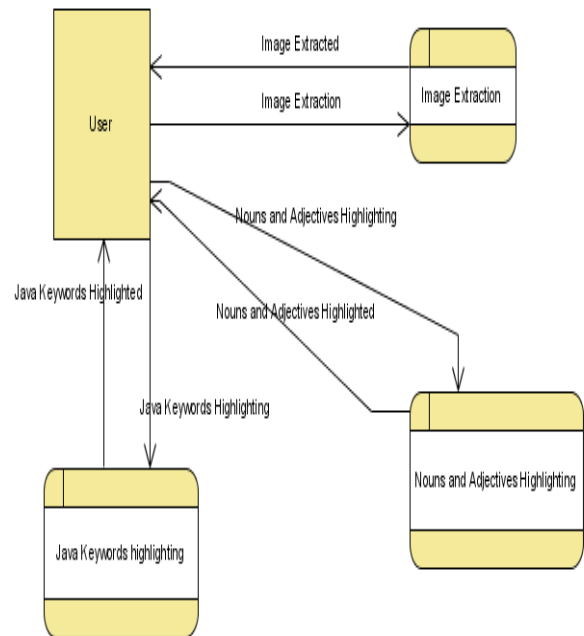


Fig 4 : DFD (Level 1)

5. Results

The IIDU system is implemented as shown in Fig 5, and experiments were carried out onto different documents falling under various categories such as trivial, regular and complex etc.

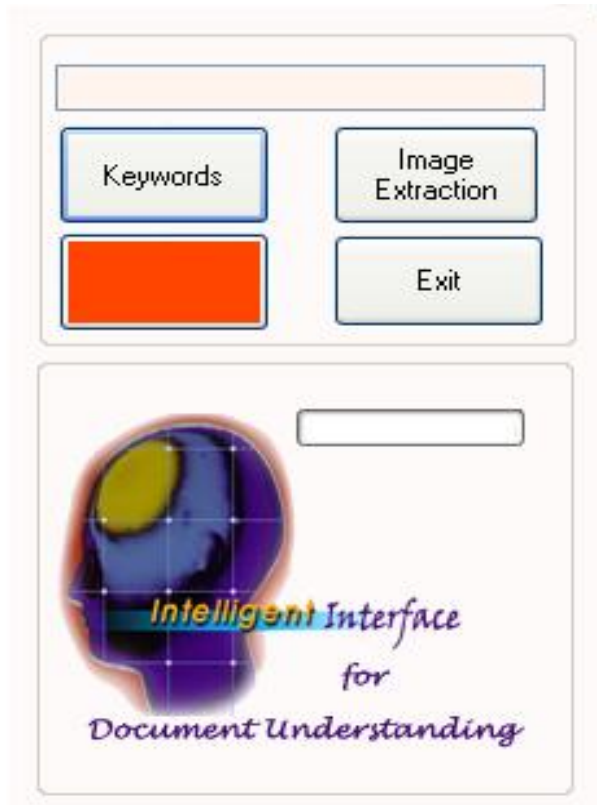


Fig 5 : IIDU system

6. Conclusion

The key features of the IIDU are summarized as :

- Overview of entire document in no time.
- Identification of Nouns, Adjectives and Keywords.
- Time efficient
- Easy identification of words
- Easy extraction of images

7. References

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