A Web-based Prototype of Fish Image Searching System

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Abstract - *To develop a system that can identify a fish by its image, this paper summarizes the system which is being developed by our group to setup the fish geometric ontology base, convert image data to morphological features and compare these features with the ontology base. The positive result will return not only the fish name, it will also return the type it belongs to, and the intuit relation of the fish identified and provide links the existing web resources and display the interested properties of habit that a user may be interested, like the akin of the fish, the living places, and its food preferences. The system is proposed for both biological researcher and normal interested web users. The program is programmed in Java. The current knowledge bases are mostly in owl format and can be converted to oracle or Mysql for uniformed web application purposes.*

Keywords: Fish Searching, Ontology Base, Morphological Ontology, OWL

1 Introduction

While we are using internet to search information every day, we need to either know the website addresses that we are planning to go or know the key words that we know the interests belongs to. If we have no knowledge of the target we are holding, it will be very hard to get any information from the internet. This is because that nearly all information and communication on the web are based on strings or characters which have been virtualized and interpreted by human beings. Only by reading through a document or the result of a search, can people understand if this information is relevant to them or not. So you have a fish in hand, and have no idea of its name and no people around you know the fish, you probably will not be able to get anything from the internet by just searching a fish, a big fish, a small fish, a red fish, or a white fish[3]. These kinds of difficulties will arouse us to build some knowledge base that can store the information of a fish's geometric and color features and the applications that can disseminate the picture of a fish into these kinds of features.

There are some works that can prescreen fish by its roundness or flatness, its sizes or its entropy, from a given set, but none of them can be used to precisely identify or classify fishes. There are a lot of jobs and applications that use ontology to do professional search, i.e., the search that have relatively fixed properties and relationship, but none of the works are available for fish. This is partly because of the lack of proper definition of ontology that can be processed by computer. There are people that propose to use chemical, molecular, or genetic method to define the ontology and thus the classification; none of these kinds of jobs are successful, even manually. The most popular method is to identify the fish by its shape, and expert will also examine the fish details like fin and inner organ to determine an unknown species. So morphological features are still the dominant features for fish classification.

Plenty of works done recently to absorb the development of computer technology to build up agricultural knowledge base and therefore the reasoning method, but most of these kinds of job are still limited to the input of existing features that are described in the textbook and index them with the ontology properties. The searching and matching are still based on the test searching techniques. This kind of manual way can hardly be utilized by computer, because of the description can be random and test search is another uncertain thing to be researched. With all those works on OWL and fish OWL, the bottleneck is still the automatic identification of fish, without know what fish it is, there is no way to go the second step.

Our previous job [1] is trying to provide a way to break this barrier. A complicated geometric and color features set is defined to simulate the human view perceptions of a fish, and further works is done [2] to use these features to do matching and pattern recognition, which paved the road of a possible fish image searching system, or, more plainly speaking, the intelligent fish recognition system that can be accessed by public over the internet.
Ontologies are useful if better scoped and-defined for a specific domain and application. Processing techniques can be used to enrich ontologies, which in turn can be used for knowledge discovery and extraction. The system will be running on the server so the complicated recognition algorithm will be not be a problem when retrieving most of fish features from images, the natural links that can be expressed in ontology relationship can utilized the flexibility of internet to access any information that a user may interest related to the current fish, and thus verify if the system provides a good solution or it just did the wrong job.

For the fish image recognition, there are some papers that use pattern recognition to do rough classification, these kinds of works are: fish identification from a given set, fish counting, fish rough counting using digital sonar image, ocean color analysis to find fishing area by the satellite images, etc[3][4]. There is no new definition of fish ontology so it can be used for pattern recognition and classification system. What is more, these are all proprietary systems and designed for special purposes, none of these applications is designed for public use and scientific educations [6].

An example [5] is that the three research results of the AOS (Agricultural Ontology Services) project in FAO (Food and Agriculture Organization) is constructing a primitive ontology in fishery area. The ontology consults ASFA (Thesaurus Aquatic Sciences Thesaurus), ARGOVOC thesaurus with multiple languages, that exposes the problem that how week a system is if it is a language relevant system.

2 Our Method

As we can see from the above information, we will build a language independent, human independent system that can be even used by a kid. This ideal situation: by flashing a fish in front of a camera, the computer will catch up a few pictures and send them to the remote server for recognition. The server will try to recognize it and prompting the kid to turn the fish around, places it closer or farther, or do it in the better illuminated environment. If the system does not find a match, it will keep sending instruction until the options are exhausted. In most cases, we can expect the system will return the name, habit and relationship information from the internet and the image withdrew from the internet should be the same or similar to the one that user is holding, which will accomplish a typical service action.

To accomplish this purpose, we need the system architecture as Fig1, where the user equipped with personal computer, internet access and camera or a cameraed fish image will pass through the image through the internet to the server, mapping into geometric ontology base, which is a few owl files, invoke the reason machine, and query the related knowledge base, which will relate to more related databases and spread the relation over the internet resources to get the total view of the species that we are working on. So a cross linked, inter-referenced knowledge reasoning machine will be the best reason for using ontology base for this kinds of interpretation.

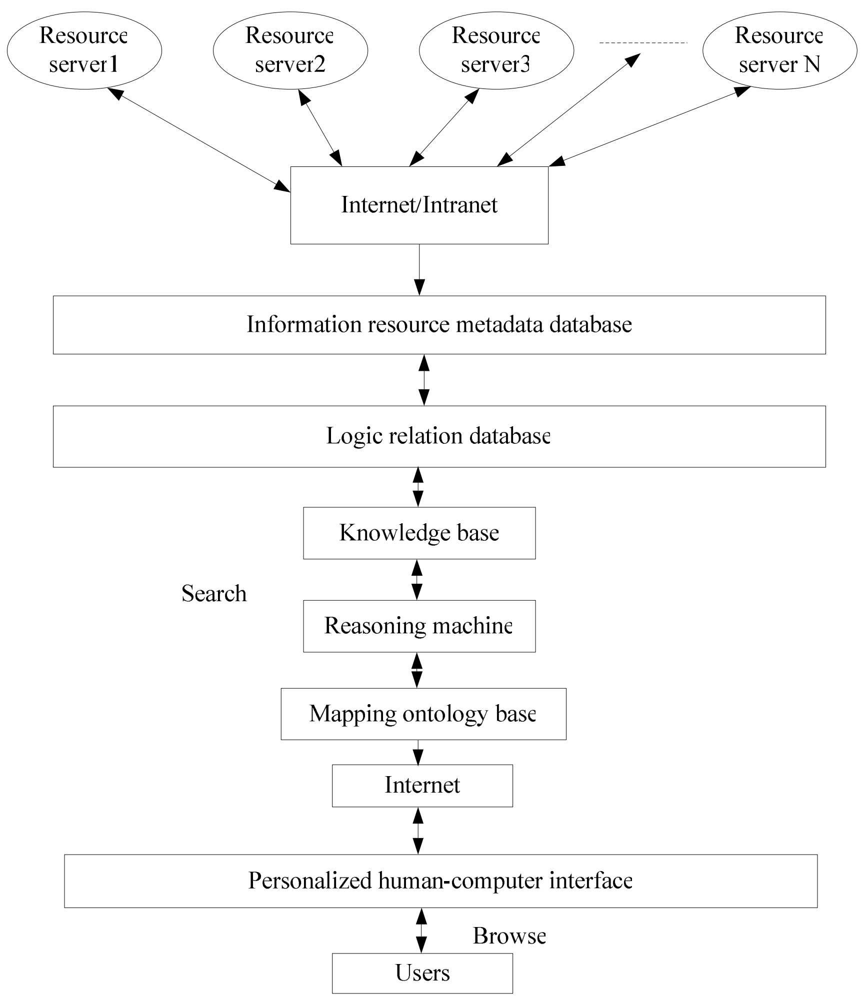


Fig1. Architecture of Fish Ontology Query Program

As a prototype, the no-matching return instruction system will not appear in this paper, only a straight functioning route is described here in Fig 2.

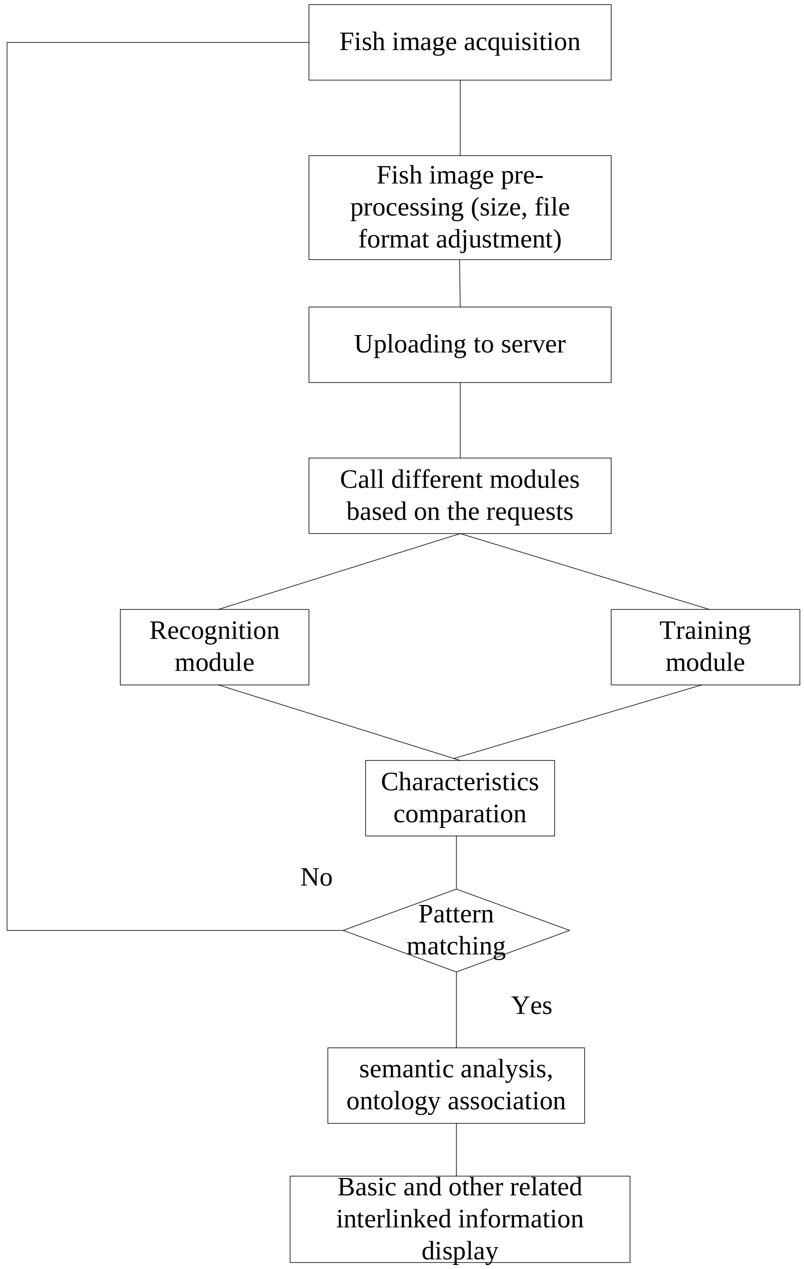


Fig2 Data flow chart of system

Fig 2 shows the data flow chart of the realization program across the platform.

In the actual application, the picture quality, the picture format and the shooting angles are all the problems that will lead to a failure search, so the future enrichment will be intelligent instruction system that can be based on the quality of the picture and the feed back to regenerate the instruction database.

The other problem is the feature definitions. Because of the huge amount of information caught by human eyes, the dozens of morphological features and color features will not be adequate to cover a fish in real life. Generally, more detailed features will help the recognition rate. In actual case, this may also decrease the recognition rate. This is because the cameraing environment can be random and the picture quality can be very different, so the features acquisition of the learning process may be a special case so the recognition picture will be discriminated.

3 Experiment

The experiment is done with a silver carp image as the target, which is shown in Fig 3. A few silver carps, common carps, snakeheads, mugil celphalus, which are shown in Fig 4 and Fig 5, are input as the learning process with word instructions.

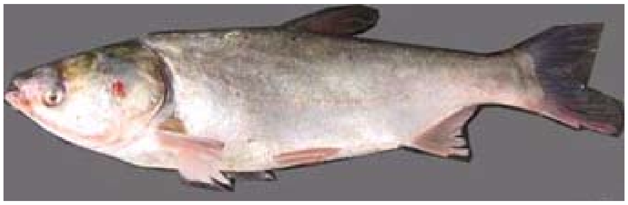


Fig.3 the Target image of silver carp

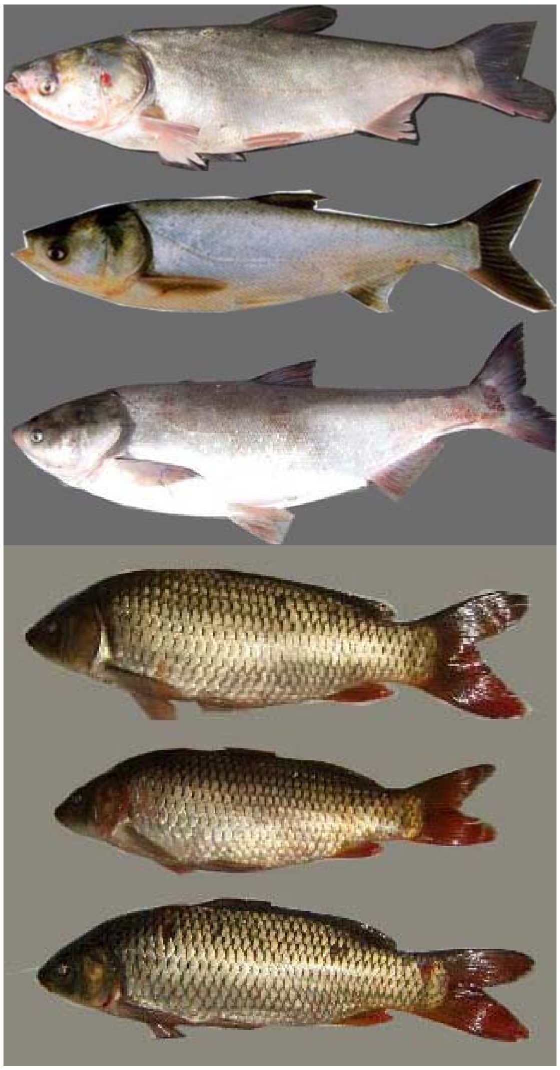


Fig.4 the Input images of silver carp and common carp

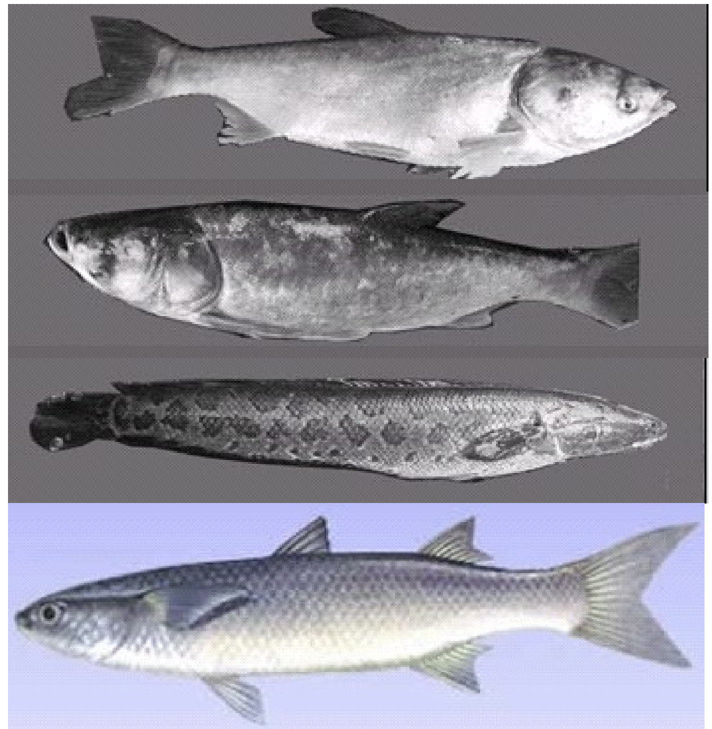
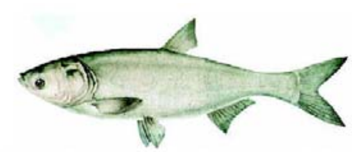


Fig.5 the Input images of more specimens of silver carp, the snakehead and the mugil celphalus

The recognition is instant and the information of silver carp can be shown in Fig 6. The system is in Chinese so the characters are all in Chinese.

If a picture of a crab or other fish which is not learned is input as the target image, the system will reject it immediately.



鲢鱼又名白鲢、，鲢子，鲢鱼也是最主要的养殖鱼类品种之一，在淡水养殖鱼产量中，它占有举足轻重的地位。

鲢鱼的分布遍及全国，并与草鱼一样，一些国家和地区也都引进，且能够自然繁殖。

（一） 形态特征 体较侧扁，口大而斜，下颌向上翘起。眼位于头部轴线之下。鳞细小。从胸鳍基的腹部正中至肛门有一隆起的“脊”——腹棱。体背部呈青灰色，两侧灰白色，腹部银白色。各鳍浅灰色。

（二） 生活习性 链鱼是中上层鱼类，性特别活泼，稍受惊动便四处窜跳，拉网捕捞时常有大量的鱼从网上越过而逃脱，但不会从网底逃窜。

天然水体中，生长季节主要在江河支流极其附属水体中肥育，冬季多集中于深水处越冬。适宜生长温度与草鱼、青鱼同。在低温季节里，鲢鱼并不停食，只是摄食强度有所降低。

与草鱼、青鱼相比，鲢鱼较喜于肥沃的水体，适宜的有机物耗氧量为20毫克/升以上。对低氧的耐性比草鱼、青鱼强。

（三） 繁 殖 鲢鱼性成熟年龄与同地区的草鱼相比，要早1——2龄，华南为2——3龄，华中3——4龄，华北4龄，东北5——6龄。成熟个体也比草鱼小，5——6斤的雌鱼便能成熟，在两广地区，2——3斤就已成熟的例子也不少见，最小的成熟个体，雌鱼体长20厘米，重325克，雄鱼体重只有240克。

Fig 6 the system layout information of silver carp image search

4 Conclusion

This prototype described in this paper can successfully learn a fish’s features from this picture, store these features in the web knowledge base. The system can also disseminate a target fish picture into pre-designed features and process the searching and reasoning action over the web, correct information will be returned in normal picturing condition.

The prototype is insufficient to provide service now because of the diversity of geometric definition and the huge variety of the fishes. More important, the picture quality and the shooting angle will limit the success retrieval of fish properties. It is expected an intelligent instruction system can be developed to instruct the user to use correct equipment (camera), shoot in correct angle, etc. So further research on ontology definition and further feature learning work need to be done in order to get a practical service system.

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