Species Identification: Fish Images with CBIR and Annotations

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Fish species identification

- Learning to identify fish is critical to the study of fish ecology and management of fisheries.
- Traditionally, dichotomous keys are used for fish identification.
- Other tools used for identification are personal notes, fisheries websites, fish images, line diagrams of fish, etc.

![Image of fish species]

Fig. 1 Species id techniques: a) Snippet of the dichotomous key, b) Printed species list with notes, c) Diagrams on a notecard

Problems

- Learning to identify fish is difficult for students.
- Dichotomous keys are fixed and can be used in limited ways; they
  - do not accommodate different learning styles, and
  - do not focus on diagnostic characteristics of species.
- Other tools are dispersed and not well integrated to work efficiently and effectively.

Issues

- Insufficient visual or descriptive information
- Absence or limited variety of reference specimens (and images)
- Tediousness of getting back to information seen (images, descriptions, etc.) and created (markings, notes, etc).
- Inability to share identification problems with others who are physically present

SuperIDR - a superimposed image description and retrieval tool

- Combines annotations, text-retrieval, and content-based image retrieval (CBIR) on parts of images
- Includes a taxonomy and key-based browser
- Is seeded with images and details of 213 freshwater fishes of Virginia

![Image of fish species]

Fig. 2. Associate parts of images with text annotations, using pen-input or key-input

![Image of fish species]

Fig. 3. a-b) Text search and results for the query “red mark” “small mouth” “printed snout” “no spots”; c-d) Content-based image search and results

Experiment

- **Goal:** To assess the usefulness of SuperIDR in species identification, examining the usefulness of annotating and retrieving parts of fish images
- **Participants:** 28 undergraduates in an Ichthyology class, working in teams of 2 with a tablet PC
- **Task:** Identify unknown fish specimen in two sessions (20 in each session). In session 1, half the teams used traditional methods (personal notes, key, websites, etc.) while the other half used SuperIDR, but in session 2, the teams swapped methods.

Table: Number of correct responders out of 20 specimens, of different teams using traditional methods and using SuperIDR.

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<td>14.57</td>
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</table>

Results summary

- Method had a significant impact on the outcome of the task (p-value=0.015).
- Mean values indicate that students had a higher likelihood of success with SuperIDR.
- So far there are no significant results which show that annotations or searching on annotations is useful, perhaps due to timing (semester end) and duration (week-long) of study.

Conclusions and future work

- SuperIDR was shown to be useful in species identification.
- Through observation and user feedback, we learned that working with parts of images helps with species identification.
- We plan to:
  - conduct further experiments with a larger collection of images to test retrieval effectiveness on parts of images, including text retrieval and CBIR;
  - make SuperIDR available for download; and
  - explore use in other fields with collections of images with significant amount of details, e.g., in art history, architecture, and other biology-based fields.

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