

# UMLS-based Automatic Image Indexing

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*To date, most accurate image retrieval techniques rely on textual descriptions of images. Our goal is to automatically generate indexing terms for an image extracted from a biomedical article by identifying Unified Medical Language System (UMLS) concepts in image caption and its discussion in the text. In a pilot evaluation of the suggested image indexing method by five physicians, a third of the automatically identified index terms were found suitable for indexing.*

## Introduction

The capacity of the UMLS Metathesaurus (Meta) component vocabularies to describe the objects and events of biomedicine was first evaluated over a decade ago using multiple volunteer subject matter experts [1]. Some of our natural language processing (NLP) tools have shown promise in a partially automated approach to indexing text of biomedical literature [2].

We are investigating application of NLP tools to assist in the description of images associated with online biomedical literature. Only about half of terms submitted by dermatologists in describing skin lesion images had matching concepts in Meta, but those terms with any match had 98% exact matches. Only about one quarter of matching terms were found in Medical Subject Headings (MeSH), the controlled vocabulary used by NLM in indexing the biomedical literature [3].

We are reporting a pilot evaluation of an automated approach to description of biomedical images using terms extracted from the captions and mentions of those images in the accompanying text.

## Methods

Images were selected at random from all images published in BMC Annals of Facial and Plastic Surgery and European Journal of Cardiovascular Imaging during a recent year. Five physicians (cardiologist, plastic surgeon, general surgeon, internist and family physician) evaluated Meta concepts matched to automatically extracted captions and mentions of 50 images each using MetaMap [4]. The images, captions, bibliographic information and full-text articles were accessed and concepts were rated using a Web-based evaluation interface. Matching UMLS concepts were rated for relevance by the method of McCray et al [5] and also for utility

in indexing the image. In addition, the concepts were matched to MeSH indexing terms assigned to the paper to evaluate if these terms are sufficient for image indexing.

## Results

2518 concepts derived from text were scored by the 5 physician subjects; of these 892 (35%) were rated as exact match to the input phrase from the caption or mention. Only 235 (26%) of these exact matches were marked as useful in indexing the image. Only 75 (5%) of the 1626 concepts not rated as exact match were rated as useful in indexing the image. The physicians submitted 255 additional terms, of which 249 (98%) had a match in Meta. Of 569 terms marked as useful for image indexing, only 214 (38%) match to MeSH terms assigned by NLM indexers to the papers containing those images. Further characteristics of the concepts judged useful for image indexing will be presented.

## Conclusions

Terms suggested by clinicians for image indexing have a high probability of matching Meta concepts present in text referencing those images; however the current automated algorithm generates many matches judged not useful for indexing.

## References

1. Humphreys BL, McCray AT, Cheh ML. Evaluating the coverage of controlled health data terminologies: report on the results of the NLM/AHCPR large scale vocabulary test. J Am Med Inform Assoc. 1997 Nov-Dec;4(6):484-500.
2. Gay CW, Kayaalp M, Aronson AR. Semi-automatic indexing of full text biomedical articles. AMIA Annu Symp Proc. 2005;:271-5.
3. Woods JW, Sneiderman CA, Hameed K, Ackerman MJ, Hatton C. Using UMLS metathesaurus concepts to describe medical images: dermatology vocabulary. Comput Biol Med. 2006 Jan;36(1):89-100
4. Aronson AR. Effective mapping of biomedical text to the UMLS Metathesaurus: the MetaMap program. Proc AMIA Symp. 2001;:17-21.
5. McCray AT, Cheh ML, Bangalore AK, Rafei K, Razi AM, Divita G, Stavri PZ. Conducting the NLM/AHCPR Large Scale Vocabulary Test: a distributed Internet-based experiment. Proc AMIA Annu Fall Symp. 1997;:560-4.