

EP16.29

Interactive medical reference database search

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Objectives

In medical imaging systems reference databases can be highly beneficial. Current methods offer search galleries for multiple use-cases, for example diagnosis assistance or pre-annotations. We aimed to extend these with user interactions in an iterative loop, where the user provides additional information to the image feature-based search algorithm in each step. This leads to improved search quality and more optimized use of reference images for a given task.

Methods

Our workflow consists of i) acquiring a new image ii) selecting initial similar images from reference dataset based on image features iii) adding user annotations (label, bounding box, segmentation) to the image features and optimize the search. The last step is iterated until an ideal result is reached.

The process is simulated with an image set of 4500 from the SUOG⁴ collection. Image features were extracted by DINO (Caron M., 2021), then text-based user inputs, in our case view and finding information encoded by BERT (Devlin J., 2018) are added to the image features.

For evaluation experts selected twenty-one typical, not ambiguous example images to compare the

image-based, image + view-based and image + view + finding-based methods using diagnosis match statistics and assessments of medical experts.

Results

Diagnosis match for an image is defined by the proportion of images with the same diagnosis from the top 10 retrieved similar images. Average diagnosis match for our image set with image features is 38%, with image + view features 46%, and with image + view + finding features 75%. Three clinical experts evaluated the retrieved images in all configurations and in 70% of the cases, the combined features provided clinically more relevant images than the image features alone.

Conclusion

Adding user interaction to image features can notably improve the efficacy of similar image search in medical imaging systems. The retrieved similar images can assist in identifying potential anomalies at early stages and support the diagnostic process.

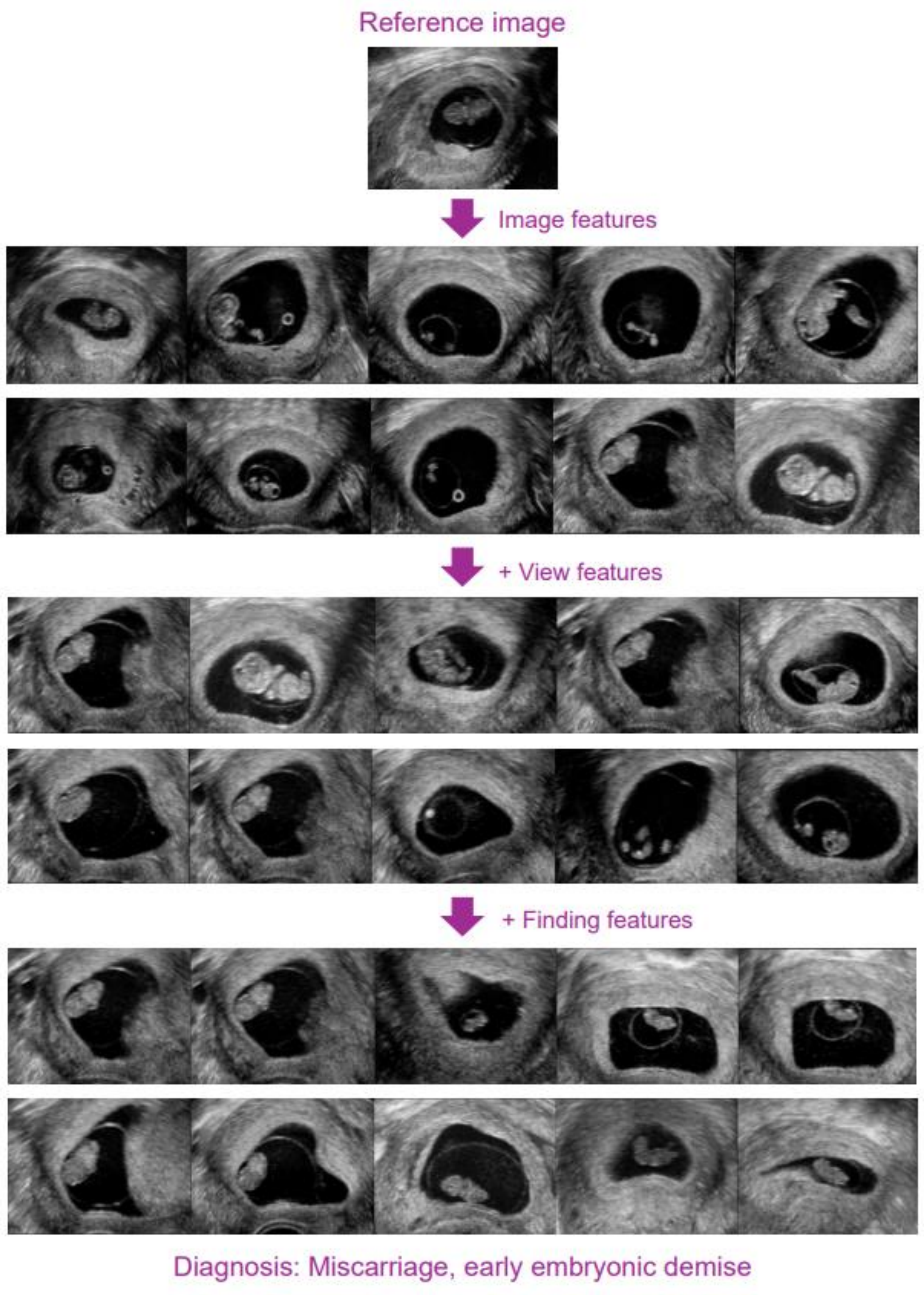


Figure 1. Example workflow

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⁴ <https://www.suog.org/>