# A Transfer Function Design for Medical Volume Data Using A Knowledge Database based on Deep Image and Primitive Intensity Profile Features Retrieval

# Online Resource

Abbreviation

CBR: Content Based Retrieval

SOI: Structure of Interest

ED: Euclidean Distance

DTW: Dynamic Time Warping

TIQ: Triplet Input Query

Table A1. Precision metrics for retrieval among six different SOIs for the ED baseline [KBKG09] and our two-stage method with the two individual compartments.

| SOIs | **Artery** | **Bone** | **Kidney** | **Liver** | **Lung** | **Spleen** | **All** |
|---|---|---|---|---|---|---|---|
| ED (baseline) | 0.451 | 0.600 | 0.326 | 0.585 | 0.814 | 0.400 | 0.580 |
| Our two-stage | 0.492 | **0.729** | **0.594** | **0.702** | **0.908** | 0.536 | **0.699** |
| DTW (individual compartment) | 0.483 | 0.716 | 0.502 | 0.688 | 0.901 | **0.563** | 0.683 |
| AlexNet (individual compartment) | **0.534** | 0.687 | 0.447 | 0.700 | 0.825 | 0.439 | 0.660 |

Table A2. Recall metrics for retrieval among six different SOIs according to different values of $N$ in the image retrieval (refer to Section 3.3). Our method outperformed the ED baseline [KBKG09] across all the SOIs regardless of the values of $N$.

| **SOIs** | **Artery** | **Bone** | **Kidney** | **Liver** | **Lung** | **Spleen** | **All** |
|---|---|---|---|---|---|---|---|
| ED (baseline) | 0.453 | 0.491 | 0.344 | 0.649 | 0.552 | 0.363 | 0.518 |
| Our method ($N$ = 5) | 0.592 | **0.695** | 0.603 | 0.762 | 0.813 | 0.529 | 0.700 |
| Our method ($N$ = 10) | 0.606 | 0.685 | 0.609 | 0.776 | 0.779 | 0.601 | 0.701 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Our method ($N$ = 15) | 0.601 | 0.692 | 0.613 | 0.776 | 0.817 | 0.634 | 0.711 |
| Our method ($N$ = 20) | 0.595 | 0.690 | 0.615 | 0.772 | 0.822 | 0.627 | 0.709 |
| Our method ($N$ = 25) | 0.602 | 0.685 | 0.636 | 0.771 | 0.825 | 0.634 | 0.711 |
| Our method ($N$ = 30) | 0.609 | 0.687 | 0.632 | **0.778** | 0.827 | 0.637 | 0.715 |
| Our method ($N$ = 35) | **0.614** | 0.692 | 0.644 | **0.778** | **0.831** | 0.637 | **0.719** |
| Our method ($N$ = 40) | 0.612 | 0.692 | **0.648** | **0.778** | 0.829 | **0.644** | **0.719** |

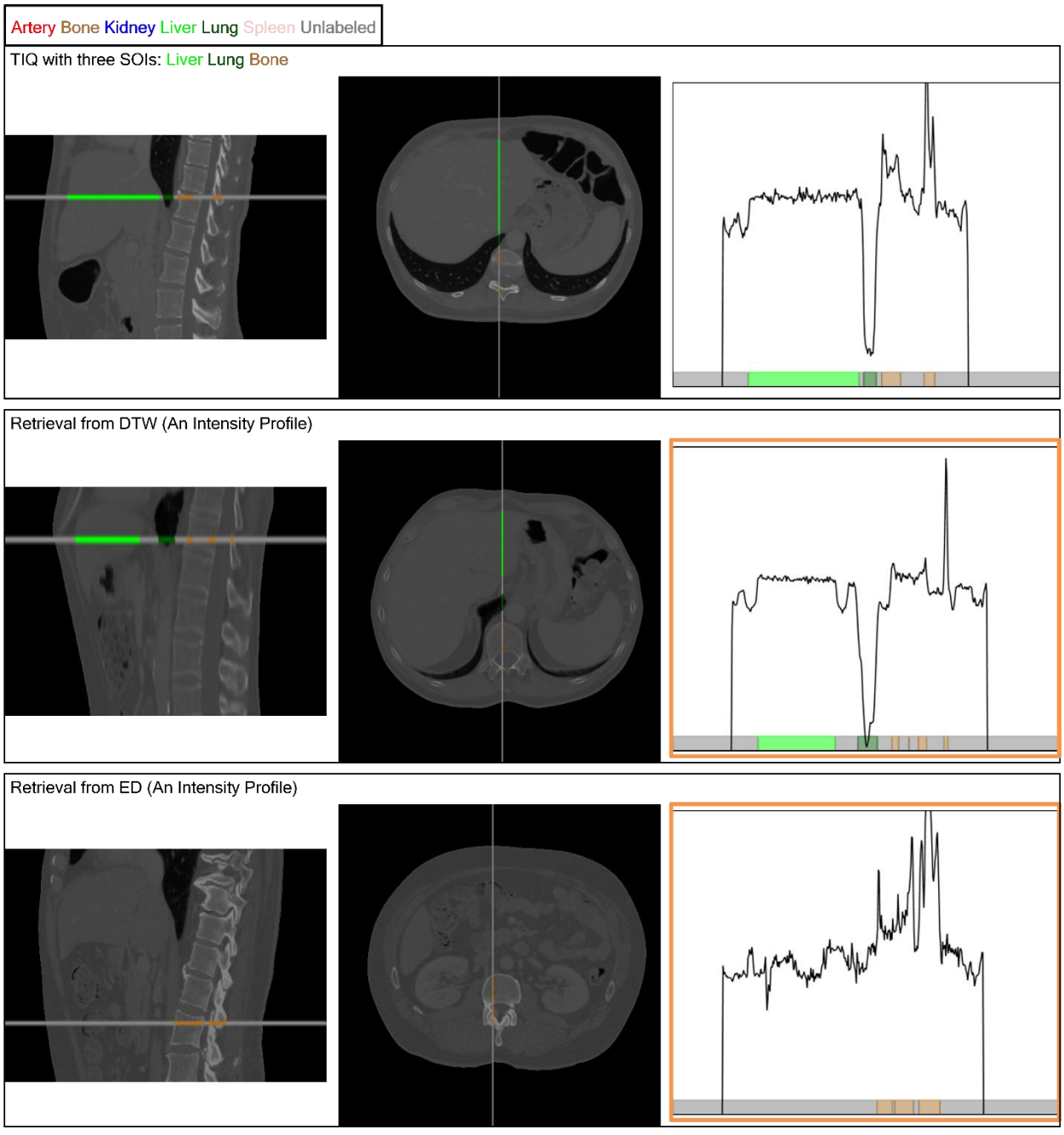

Figure A1. A comparison of our DTW method (middle row) with the ED baseline method [KBKG09] (bottom row) in intensity profile only retrieval for a TIQ (top row) that encounters three SOIs: the liver (bright green color), lung (dark green color), and bones (brown color). The bounding boxes with orange color lines indicate the compartment used for the retrieval computation, i.e., the image pairs (the two left columns) corresponding to the TIQ are presented for illustrative purposes and not used in the retrieval. Our DTW method retrieved the intensity profile that contained the same SOIs as along the TIQ while the ED baseline failed to achieve this, i.e., the liver and lung did not exist on the retrieved intensity profile. This is attributed to the capability of DTW to account for subtle differences between similar 1D signals (intensity profiles) by locally warping a signal to another signal. This is useful in medical images of our applications where the same SOI on different patients forming a knowledge database can have variations in size, i.e., the exact same case could often not exist in a knowledge database. In contrast, the ED baseline is voxel-wise matching in nature, i.e., only considers voxel pairs that are exactly in the same position and cannot account for the patient variation.

References

[KBKG09] KOHLMANN P., BRUCKNER S., KANITSAR A., GROLLER M. E.: Contextual picking of volumetric structures. In 2009 IEEE Pacific Visualization Symposium (2009), IEEE, pp. 185–192. 2, 4, 6, 7, 9, 10