

Supplementary: Multi-disease Detection in Retinal Images Guided by Disease Causal Estimation

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1 Cases in LID-FFA

Several cases in the LID-FFA are depicted in **Fig. 1**. It includes six pathological features: Leakage (L), Transmission and Pooling (TP), Staining (ST), Shading (SH), Non-Perfusion (NP), and Vessel Abnormality (VA).

2 Visualization of Causal Matrix

we visualized the causal matrix with row normalization. As shown in **Fig 2** and **Fig 3**. To facilitate clearer comparison, a binary process was applied based on a Top-K threshold. It can be observed that compared with the label-co-occurrence, the causal matrix can capture a similar relationship among diseases.

References

1. Lin, J., Cai, Q., Lin, M.: Multi-label classification of fundus images with graph convolutional network and self-supervised learning. *IEEE Signal Processing Letters* **28**, 454–458 (2021). <https://doi.org/10.1109/LSP.2021.3057548>

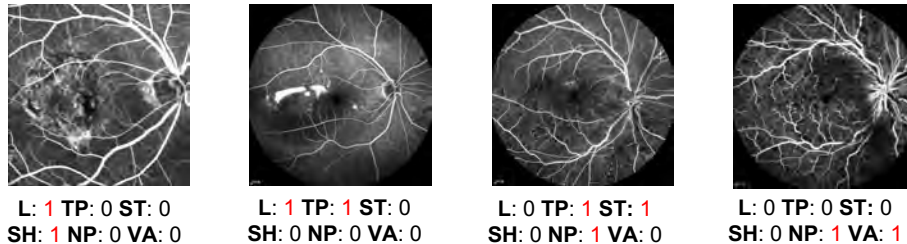


Fig. 1. Cases of LID-FFA, where 1 means the pathology is present.

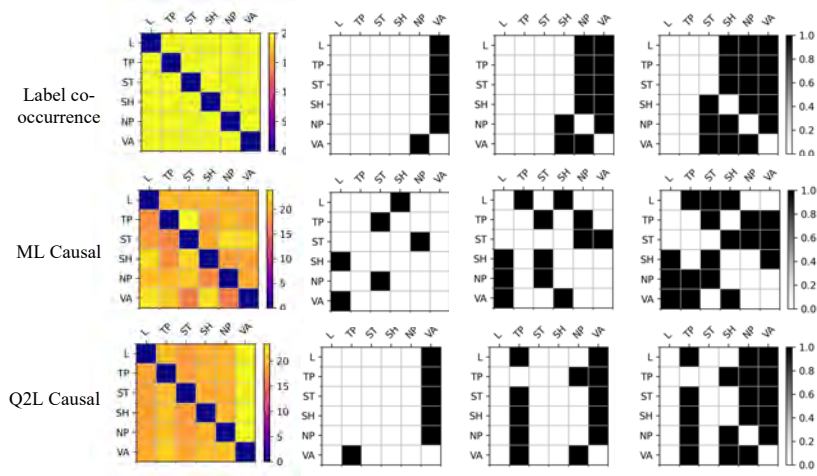


Fig. 2. Visualization of the causal matrix for the EXAMPLE-FFA dataset: The first row represents label co-occurrence generated by [1], and the second row illustrates the causal matrix generated by ML causal, and the second row illustrates the causal matrix generated by QL causal. Column (a) displays the original matrix, while columns (b)-(d) depict the Top-K binary matrices for $K=1, 2,$ and 3 respectively.

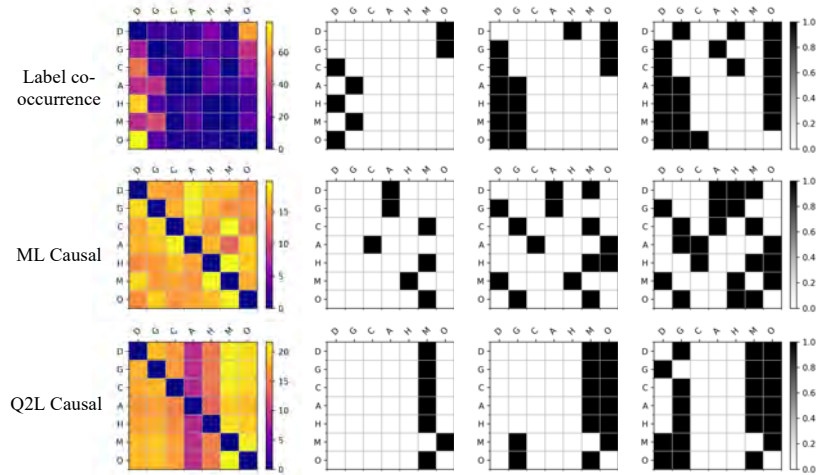


Fig. 3. Visualization of the causal matrix for the OIA-ODIR dataset: The first row represents label co-occurrence generated by [1], and the second row illustrates the causal matrix generated by ML causal, and the second row illustrates the causal matrix generated by QL causal. Column (a) displays the original matrix, while columns (b)-(d) depict the Top-K binary matrices for $K=1, 2,$ and 3 respectively.