CrossMoDA Computational Competition: Evolution of Cross-Modality Domain Adaptation Techniques for Vestibular Schwannoma and Cochlea Segmentation from 2021 to 2023

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Introduction

The Cross-Modality Domain Adaptation (CrossMoDA) challenge:

- Initiated in 2021 alongside the MICCAI (Dorent et al.,2023)
- Transferring knowledge from contrast-enhanced T1 (ceT1) to T2 MRI.
- Vestibular Schwannoma (VS) and cochlea segmentation.

Why T2 Imaging?

- Safer alternative to ceT1 and cost-efficient.

Dataset

2021: London Single-center Gamma-Knife (SC-GK) for 2-class segmentation (VS and cochlea).

2022: Tilburg-SC-GK datasets introduced.

2023: UK-MC-RC (Multi-center routine-clinical) heterogeneous datasets for 3 class (intra-/extra VS and cochlea) segmentation.

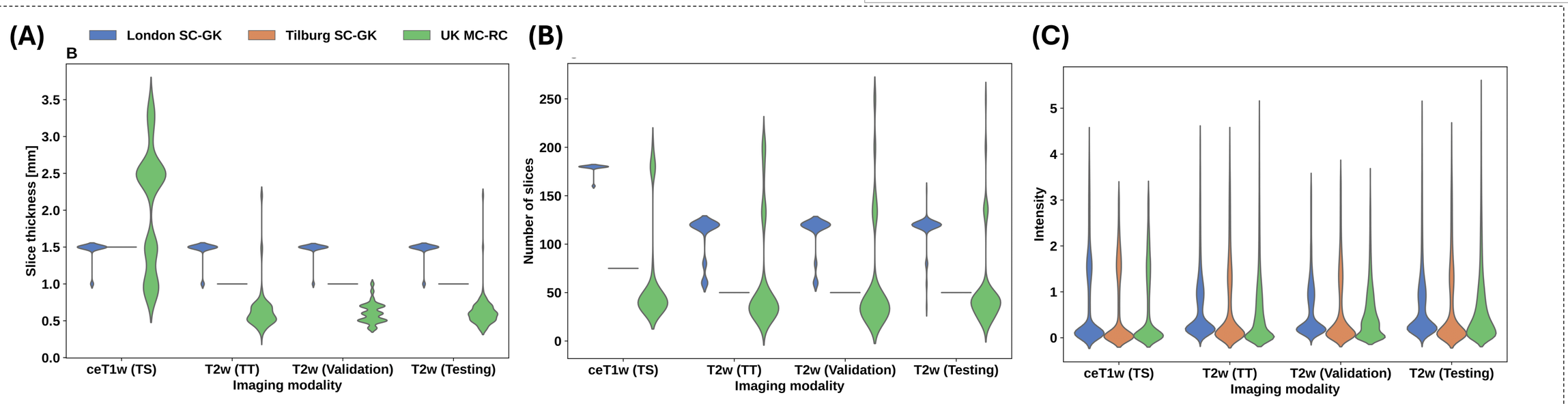

Figure 1. Diversity of the datasets presented through **(A)** slice thickness **(B)** number of slices **(C)** intensity

Challenge observations

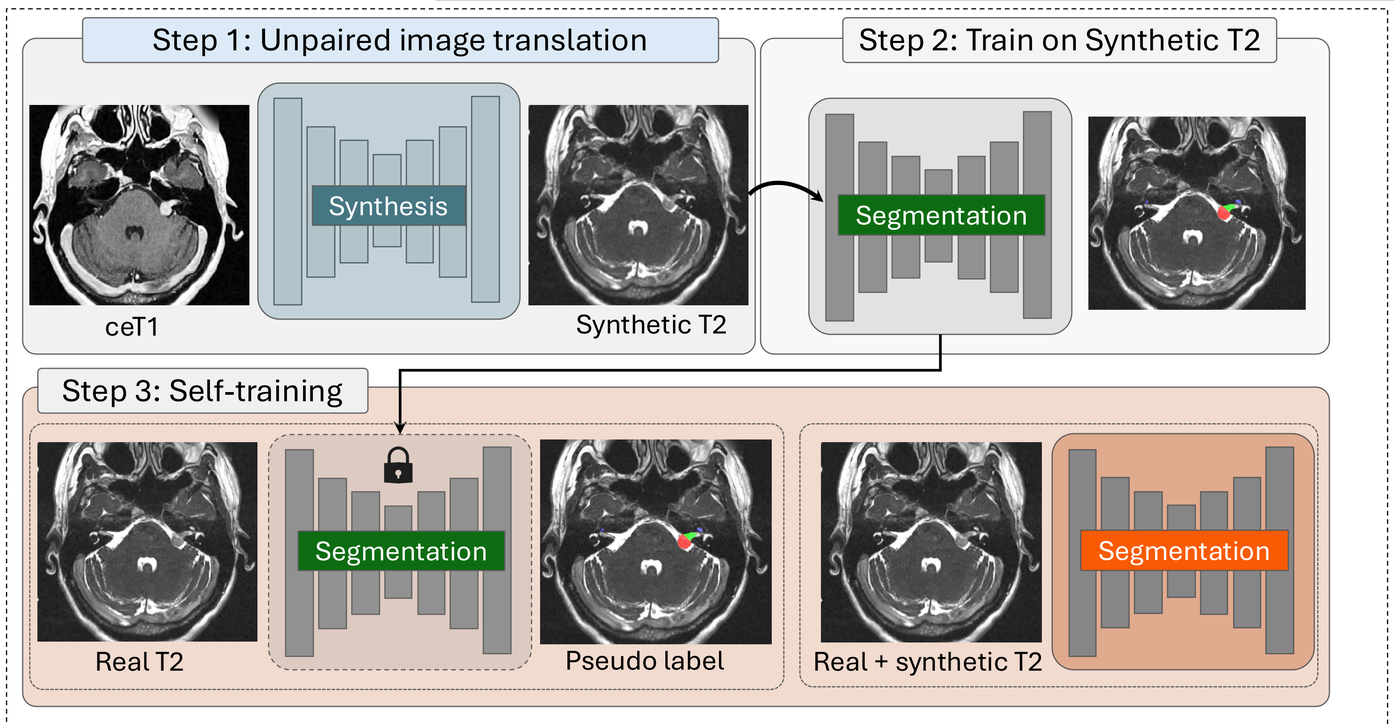

Figure 2. Three key stages of a widely adopted approach

- Performance evaluation: Dice and ASSD

$$\text{Dice} = \frac{2 \times \square}{\square + \square} \qquad \text{ASSD} = \text{average}\left[\ \right]$$

- Reduced outliers with progressively larger and more diverse datasets introduced in each edition.
- Reduced cochlea Dice in the 2023, due to the challenge of maintaining high performance across 3 classes.

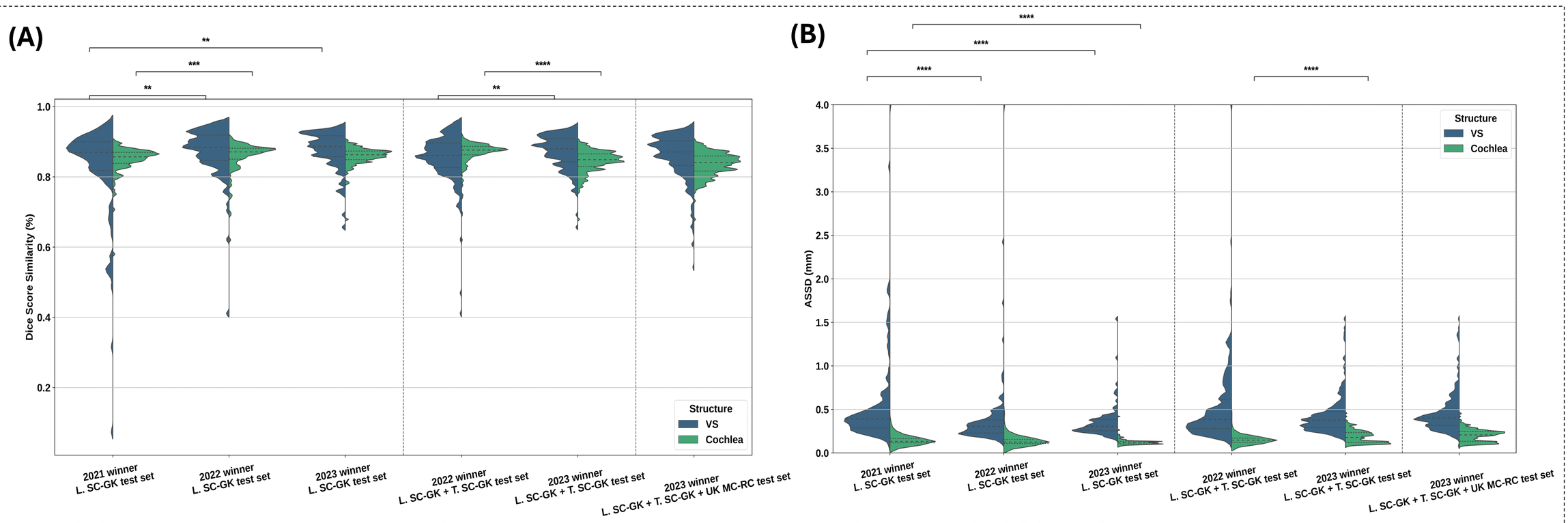

Figure 3. Overall performance by the latest winning teams across previous editions **(A)** Dice score **(B)** ASSD for VS and cochlea

Conclusions

The CrossMoDA challenge (2021–2023) evolved from single-institutional, homogeneous data to multi-institutional, heterogeneous datasets, enhancing model generalizability and clinical applicability.

Reference

Dorent, Reuben, et al. "CrossMoDA 2021 challenge: Benchmark of cross-modality domain adaptation techniques for vestibular schwannoma and cochlea segmentation." *Medical Image Analysis* 83 (2023): 102628.

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