

Adaptive adversarial neural networks for the analysis of lossy and domain-shifted datasets of medical images

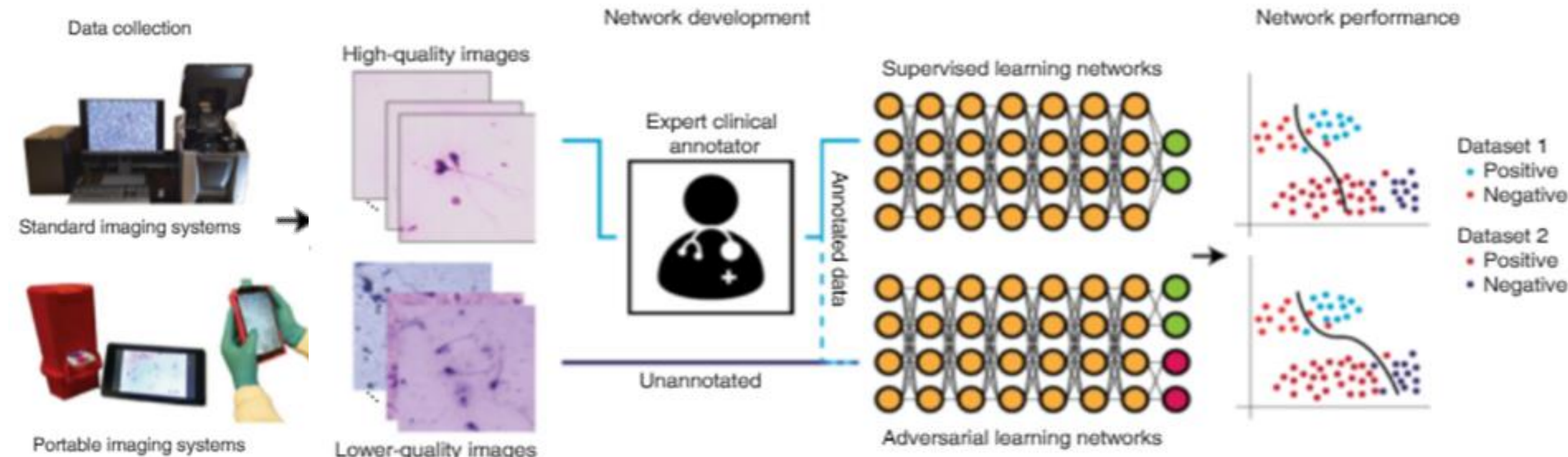


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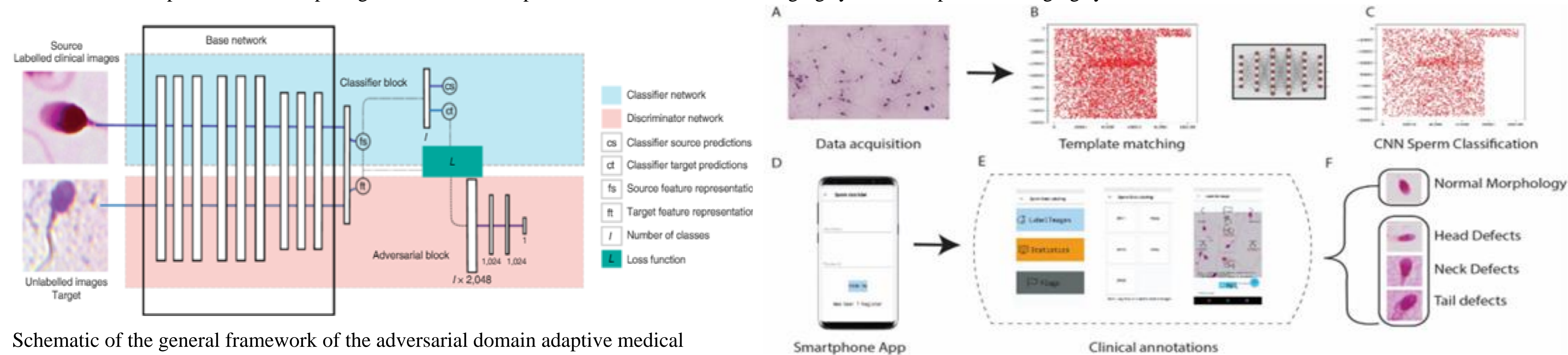
Introduction

- Manual image-based sperm morphology assessment continues to be the gold-standard modality in clinical analysis as other proposed technologies are either too expensive or inaccurate.
- Here, we show that adversarial learning can be used to develop high-performing networks trained on unannotated medical images of varying image quality specifically using low-quality images acquired using inexpensive portable optical systems to train networks for the quantification of human sperm morphology.

Method



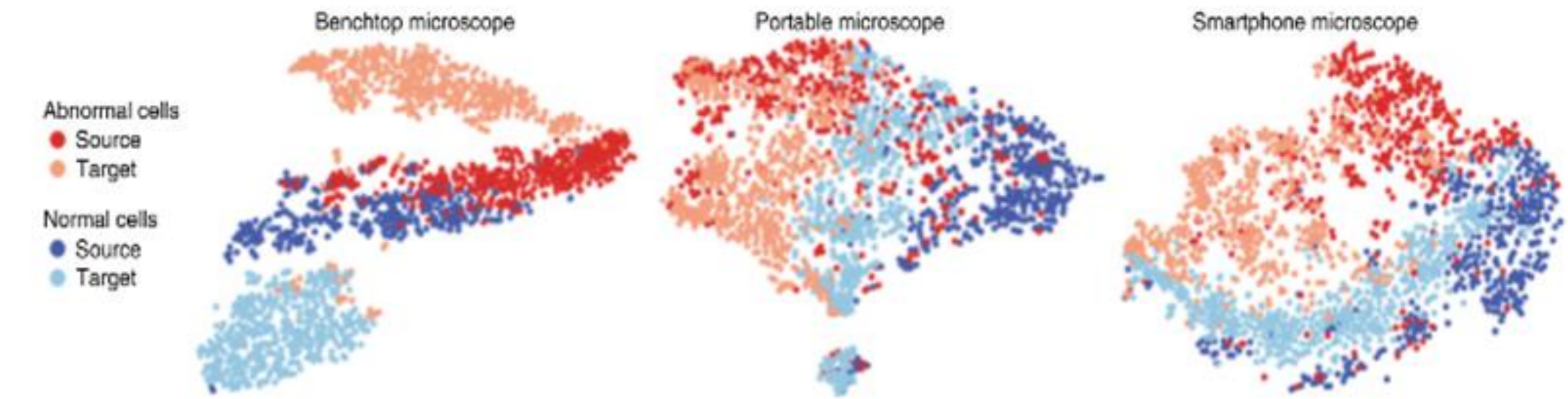
Overall process flow comparing data and network performance from standard imaging systems and portable imaging systems



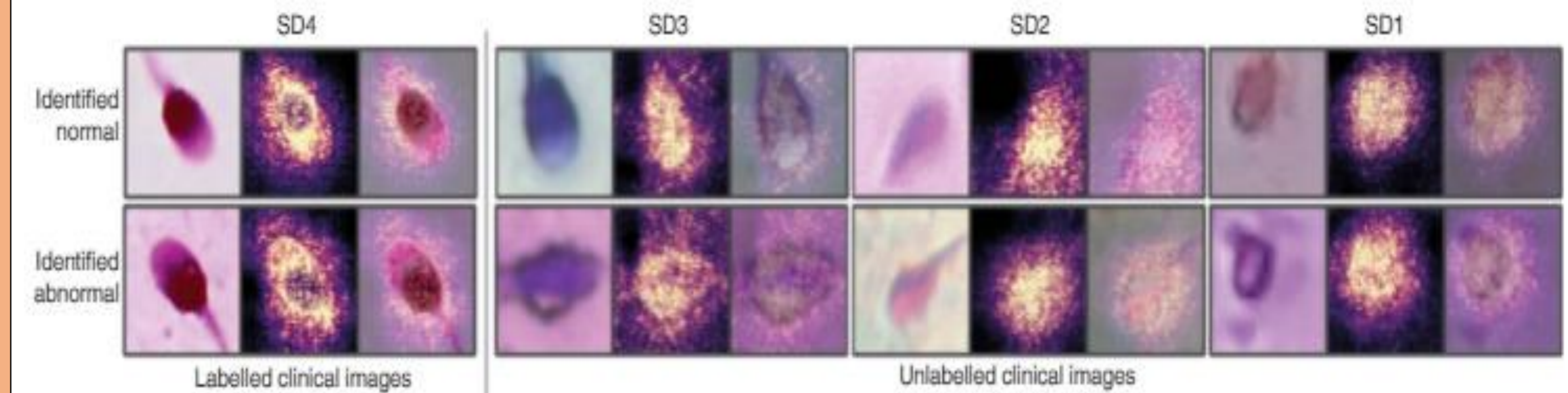
Schematic of the general framework of the adversarial domain adaptive medical neural networks (MD-nets)

Sperm data collection & annotation process flow

Results



t-SNE plots illustrating source and target clustering achieved by MD-net for the four different sperm datasets



Examples of sperm images that were collected using the different optical instruments along with the associated saliency maps obtained from the MD-net feature extractor.

Conclusion

- MD-nets, which emphasize retaining source information through unsupervised domain adaptation, can enable the development of inexpensive and portable image analysis-based screening tools for such point-of-care clinical applications.
- The findings could allow for improved access to and standardization of care even in resource-limited settings.