

Optical Coherence Tomography Harmonization with Anatomy-Guided Latent Metric Schrödinger Bridges

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Shimeng Wang,¹ Junyu Chen,² Bruno M. Jedynek,³ Shiv Saidha,²
Peter A. Calabresi,² Aaron Carass,¹ and Jerry L. Prince¹

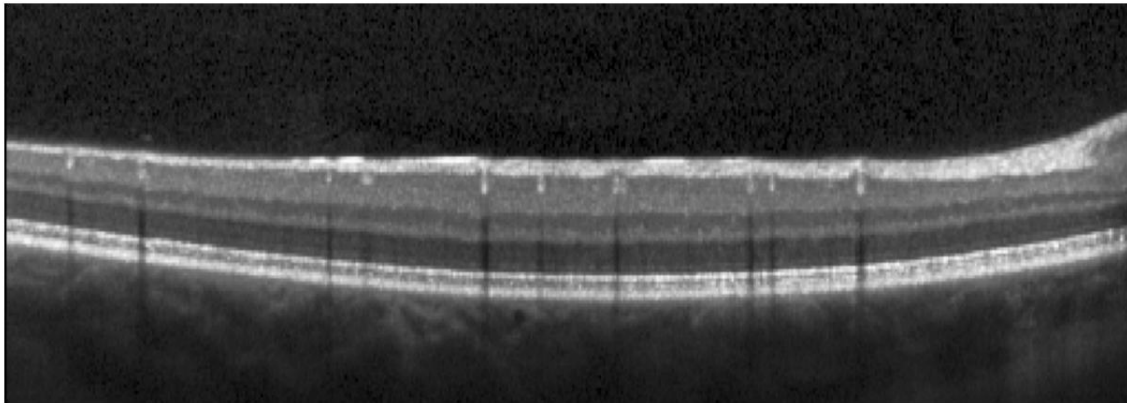
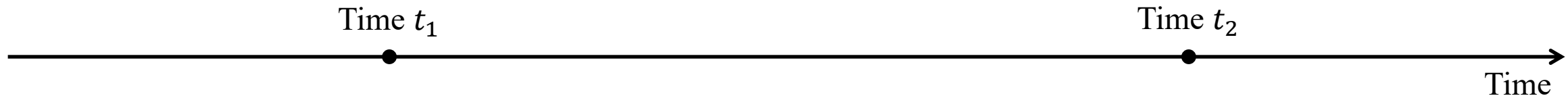
¹Johns Hopkins University

²Johns Hopkins School of Medicine

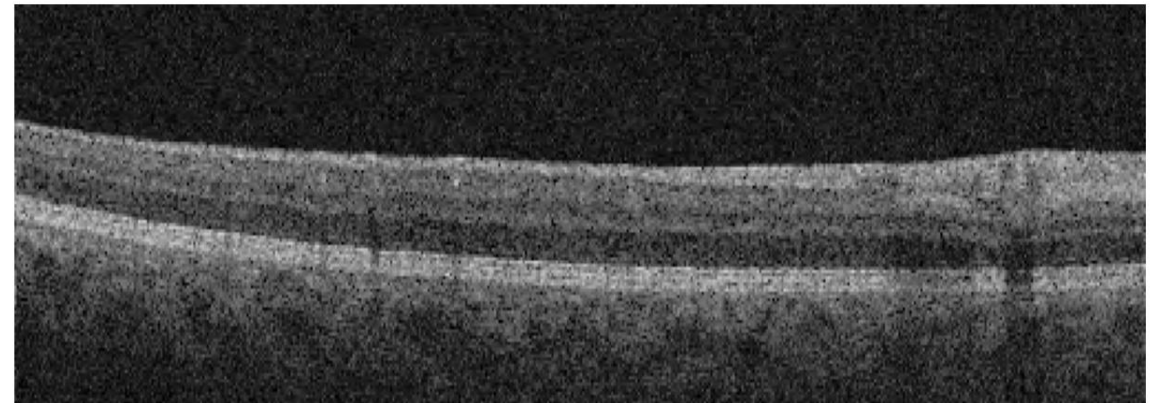
³Portland State University

Motivation for Image Harmonization

- A subject can have retinal scans using different optical coherence tomography (OCT) devices at different time points.



Spectralis OCT
(Heidelberg Engineering, Heidelberg, Germany)

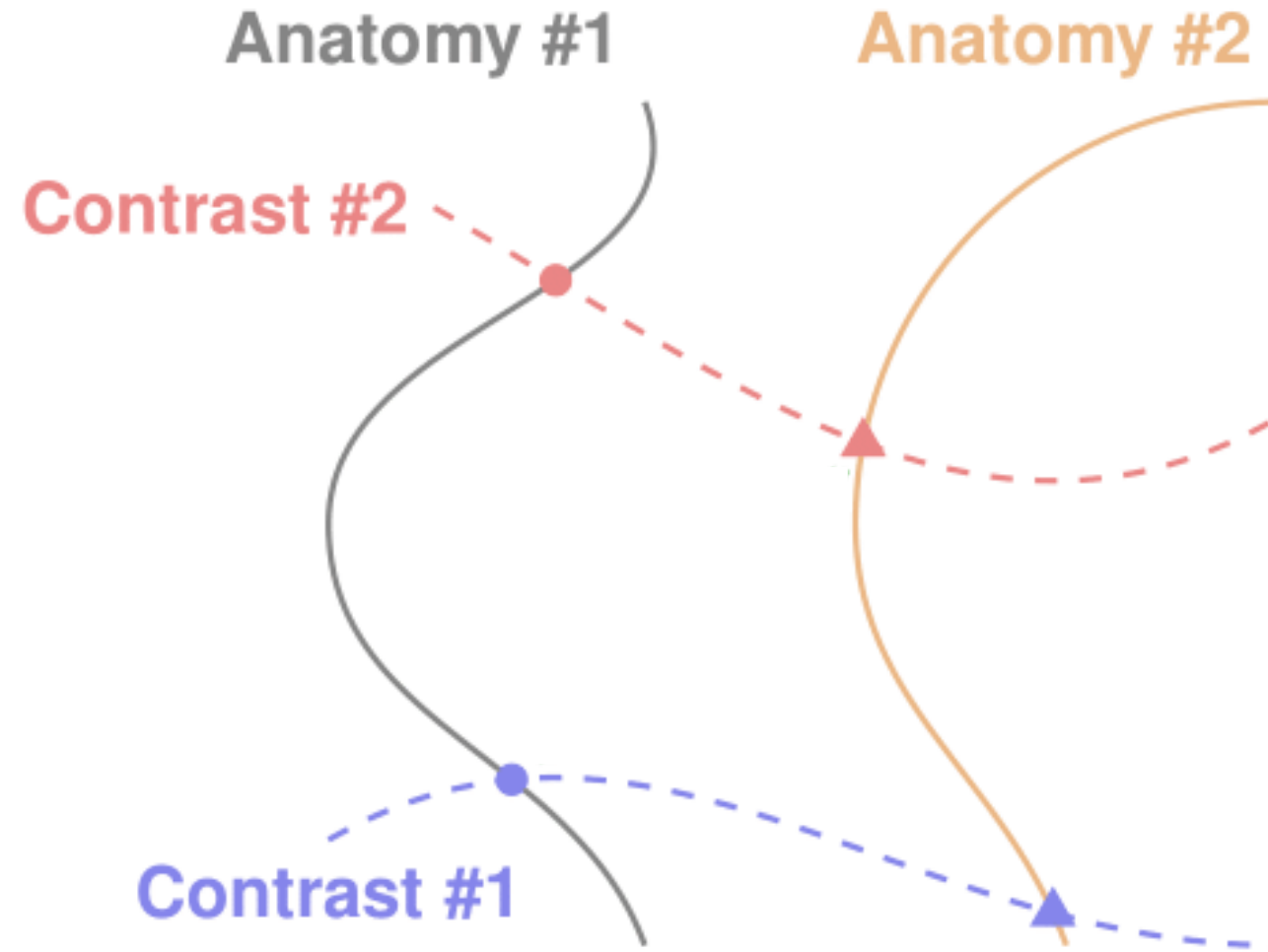


Cirrus OCT
(Carl Zeiss Meditec, Dublin, CA, USA)

Diffusion Schrödinger Bridge Matching (DSBM)

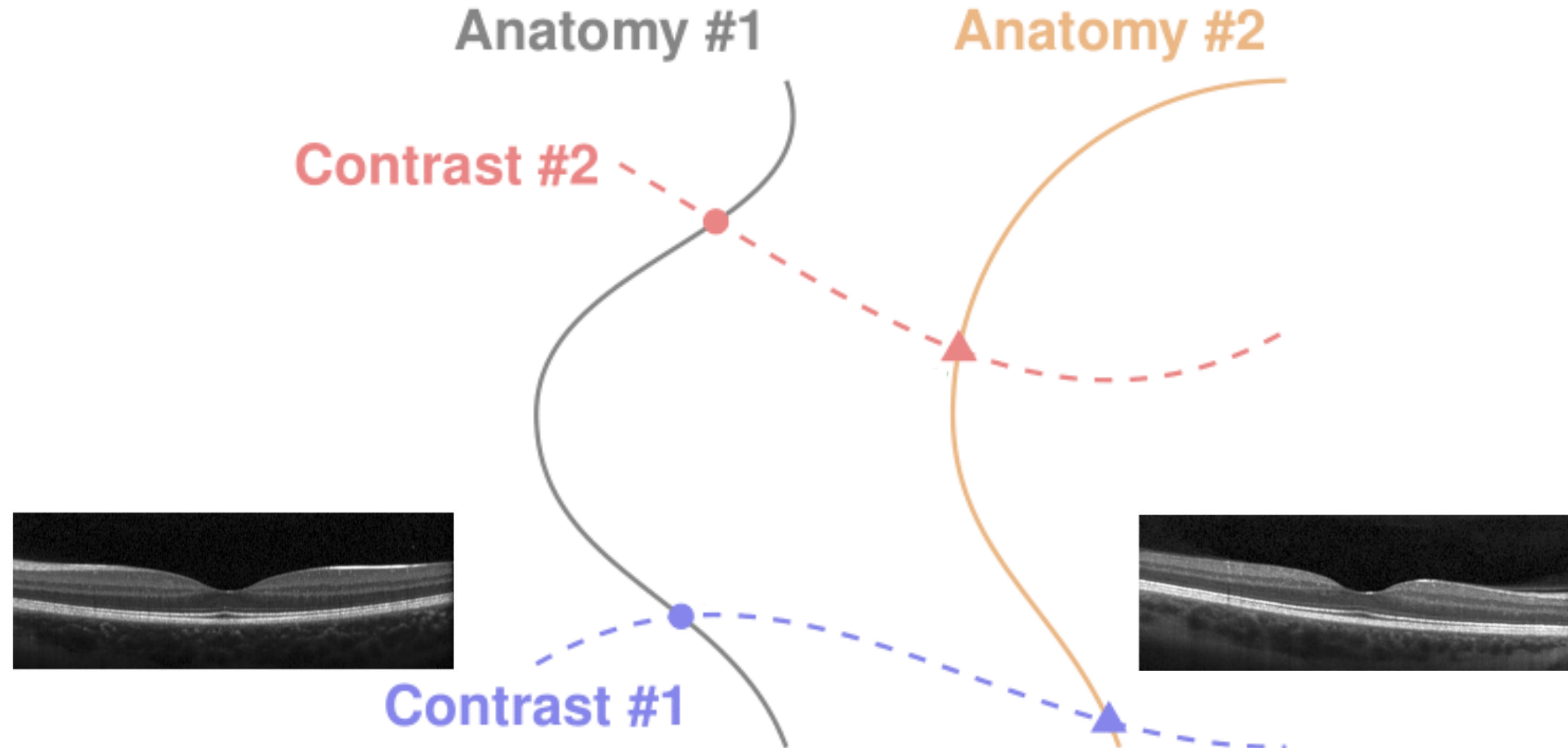


- DSBM causes anatomy shift



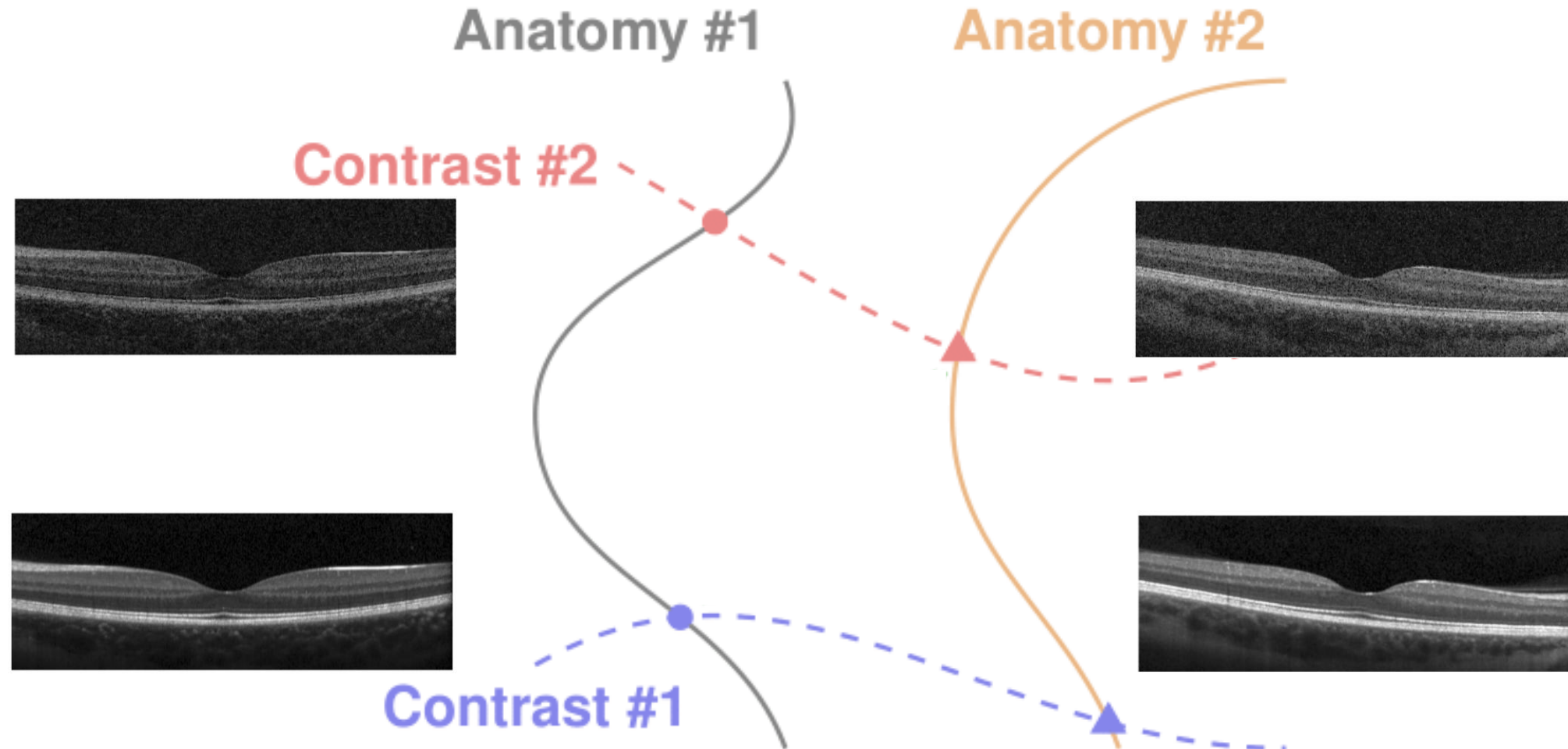
Diffusion Schrödinger Bridge Matching (DSBM)

- DSBM causes anatomy shift



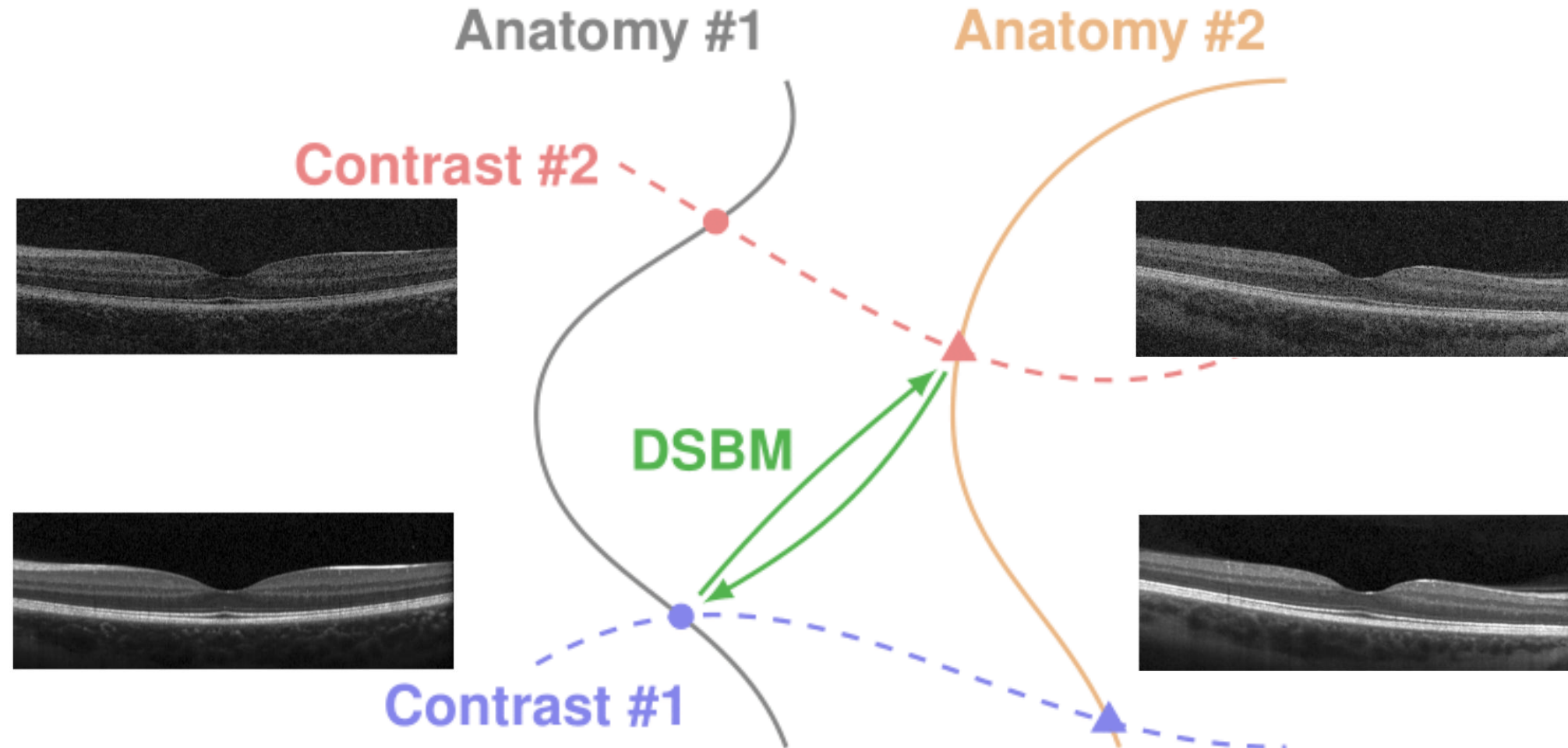
Diffusion Schrödinger Bridge Matching (DSBM)

- DSBM causes anatomy shift



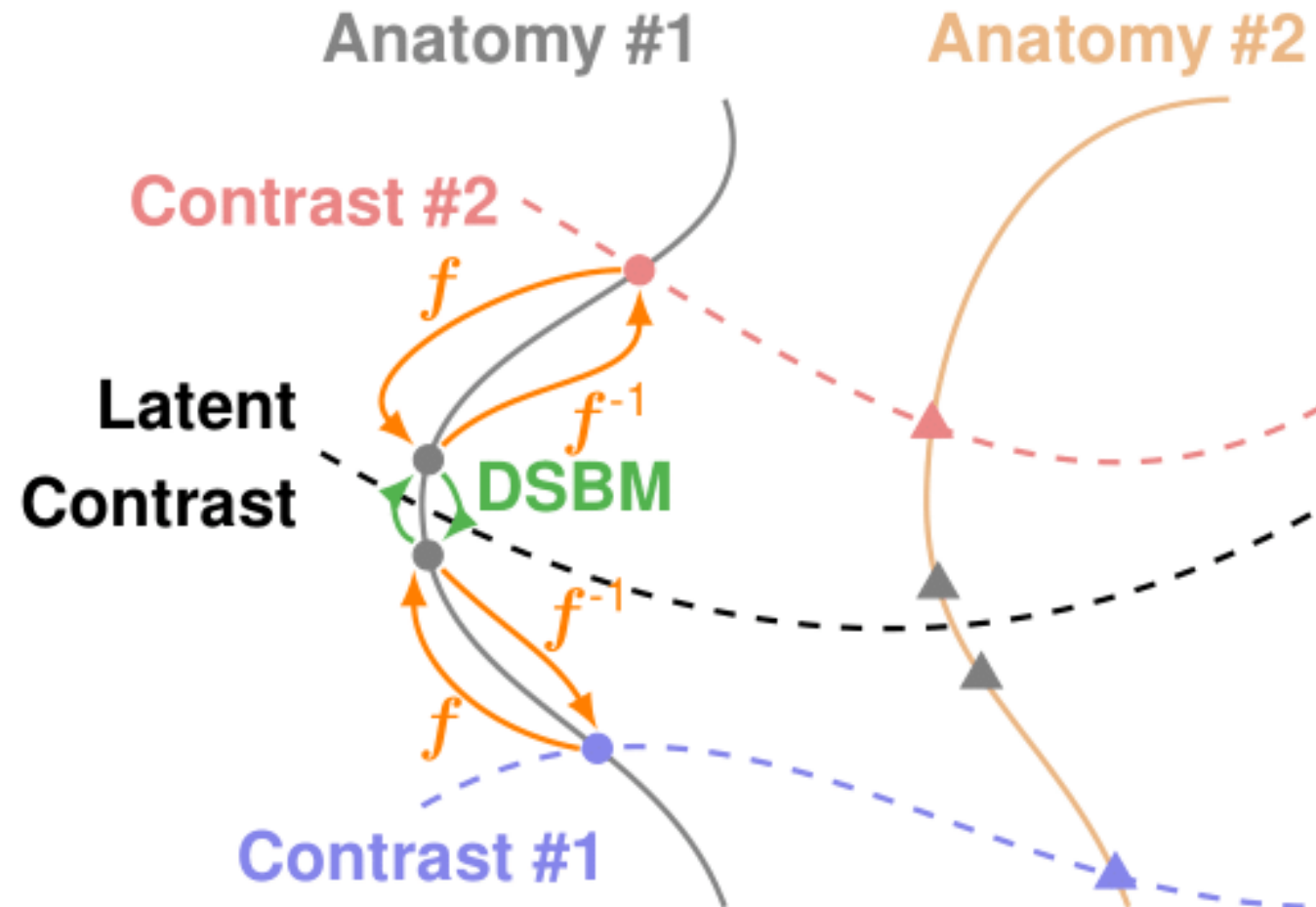
Diffusion Schrödinger Bridge Matching (DSBM)

- DSBM causes anatomy shift



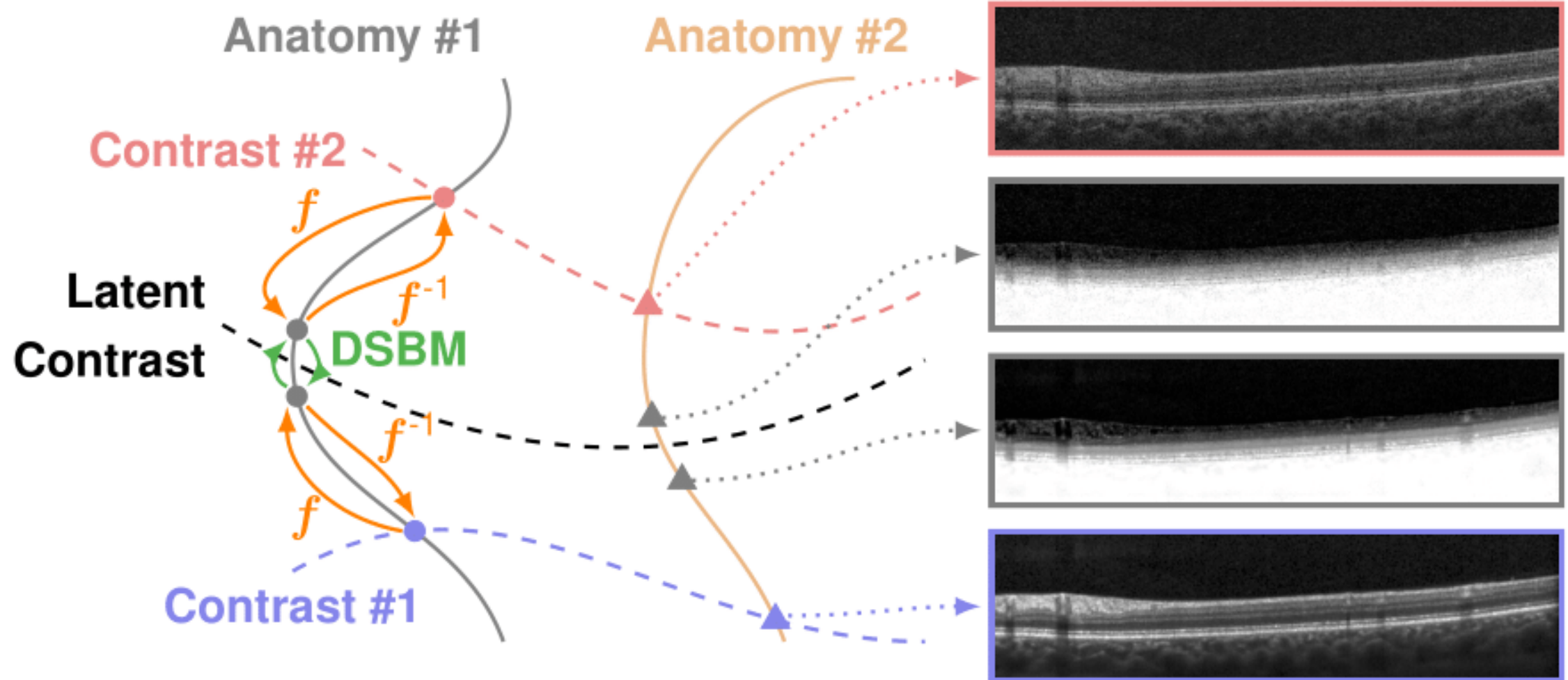
Latent Metric Schrödinger Bridge (LMSB)

- Proposed LMSB reduces anatomy shift



Latent Metric Schrödinger Bridge (LMSB)

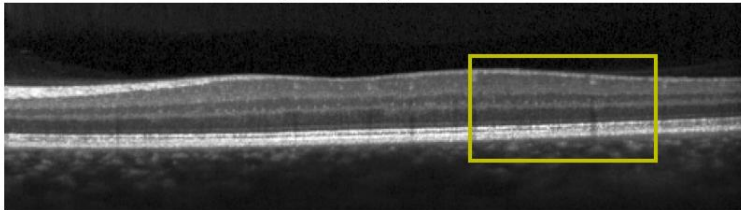
- Proposed LMSB reduces anatomy shift



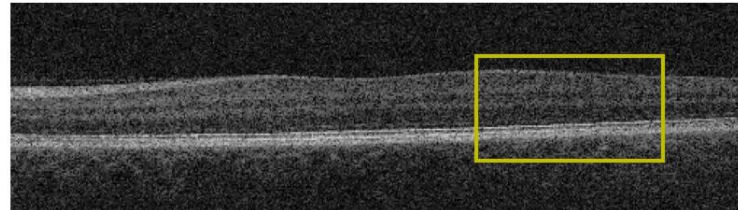
Spectralis to Cirrus Harmonization

Spectralis to Cirrus

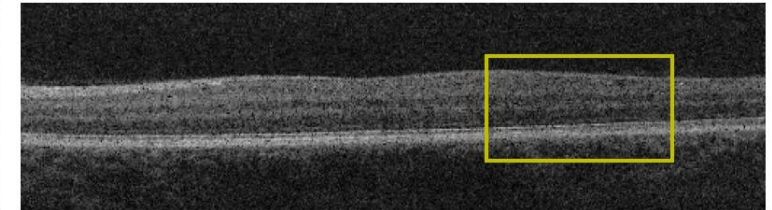
Original Spectralis



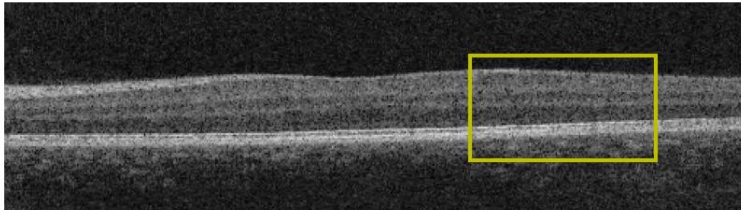
DSBM SDE MAE: 0.53 LNCC: 0.15



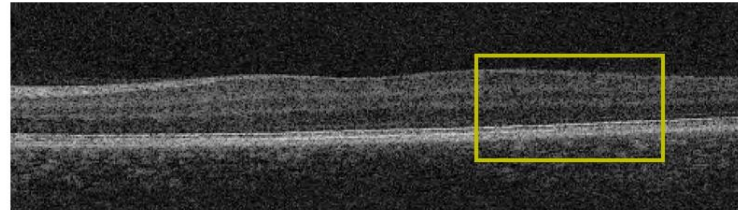
LMSB SDE MAE: 0.31 LNCC: 0.17



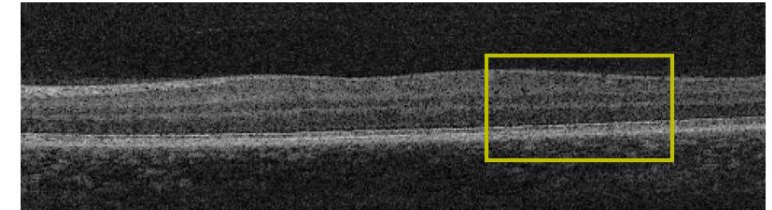
DDIB ODE MAE: 0.41 LNCC: 0.70



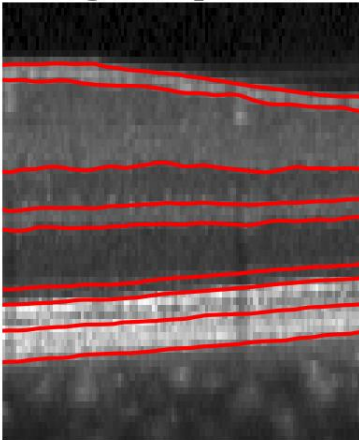
DSBM ODE MAE: 0.49 LNCC: 0.63



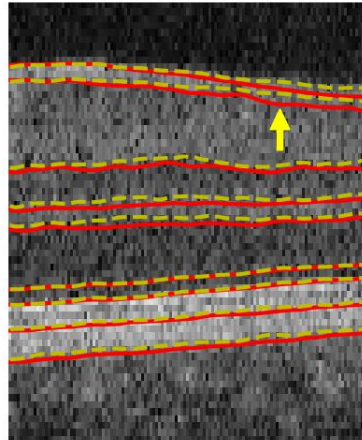
LMSB ODE MAE: 0.31 LNCC: 0.68



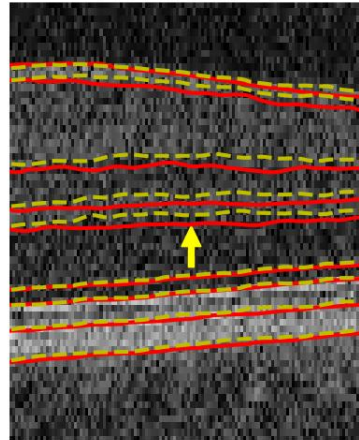
Original Spectralis



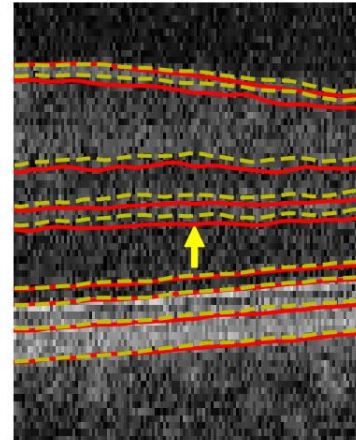
DDIB ODE



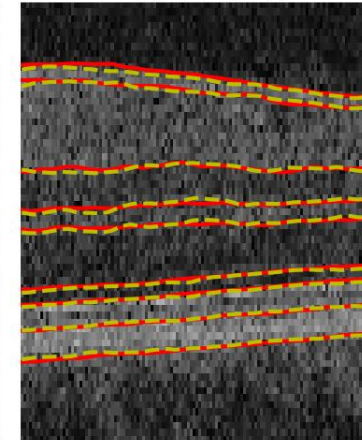
DSBM SDE



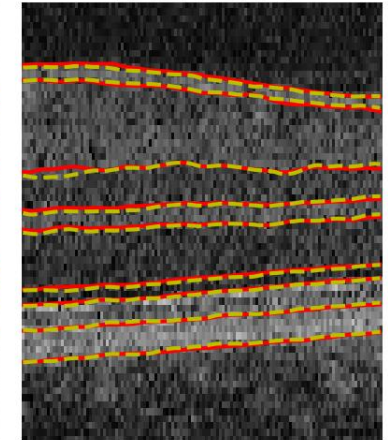
DSBM ODE



LMSB SDE



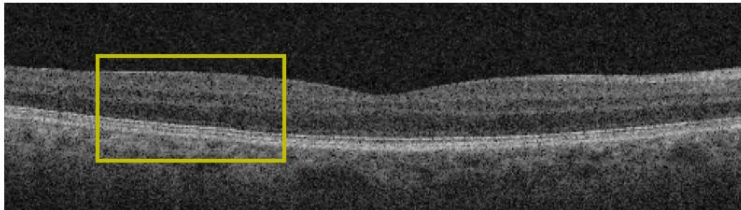
LMSB ODE



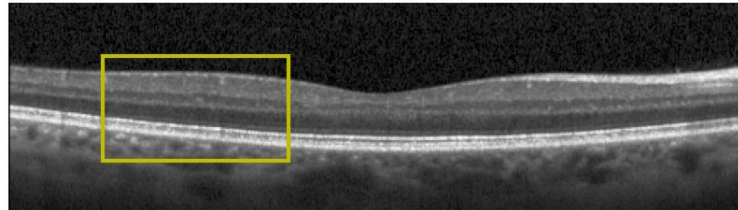
Cirrus to Spectralis Harmonization

Cirrus to Spectralis

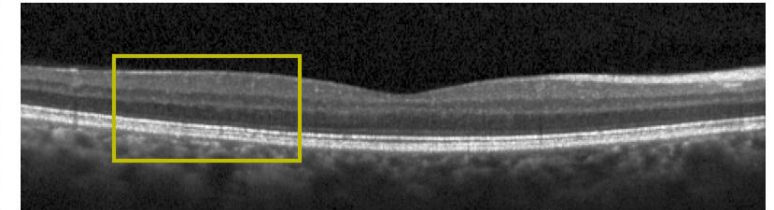
Original Cirrus



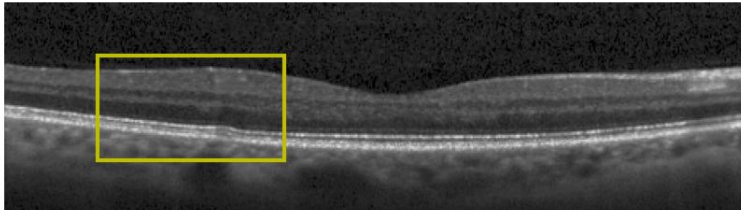
DSBM SDE MAE: 0.44 LNCC: 0.16



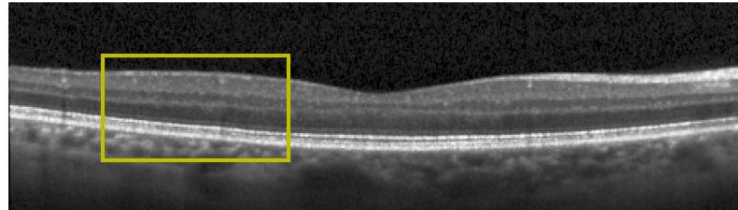
LMSB SDE MAE: 0.33 LNCC: 0.17



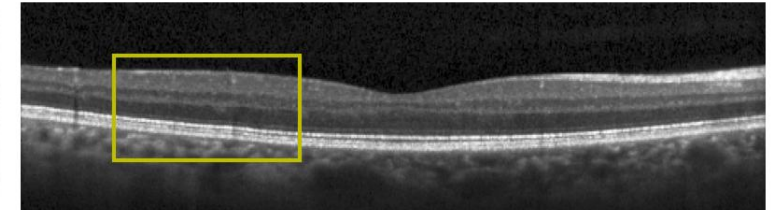
DDIB ODE MAE: 0.50 LNCC: 0.68



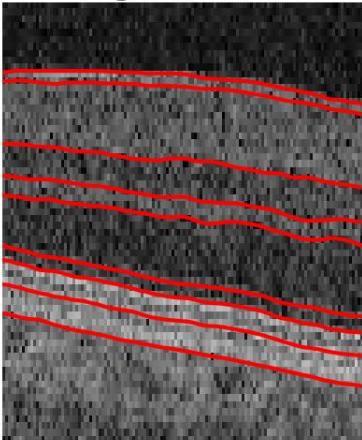
DSBM ODE MAE: 0.40 LNCC: 0.67



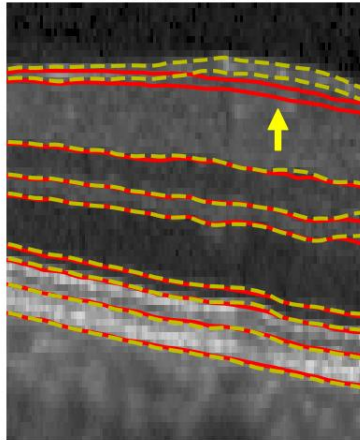
LMSB ODE MAE: 0.26 LNCC: 0.71



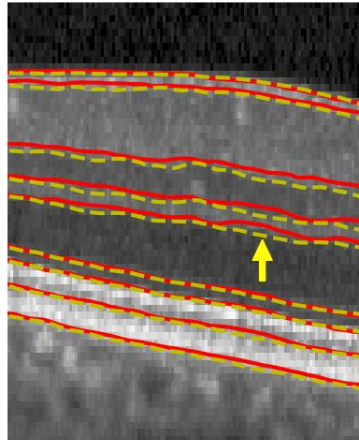
Original Cirrus



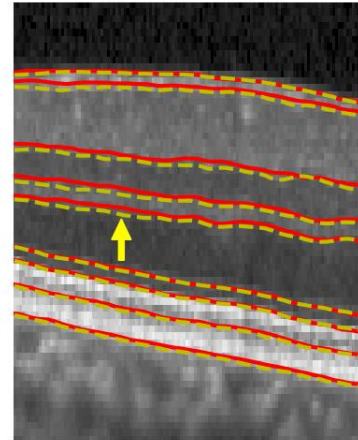
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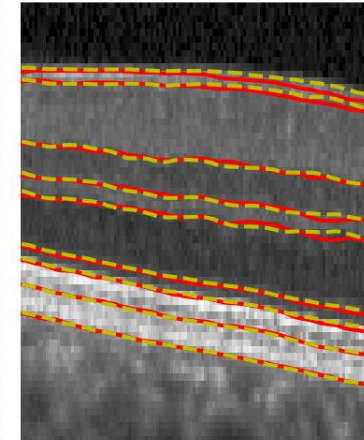
DSBM SDE



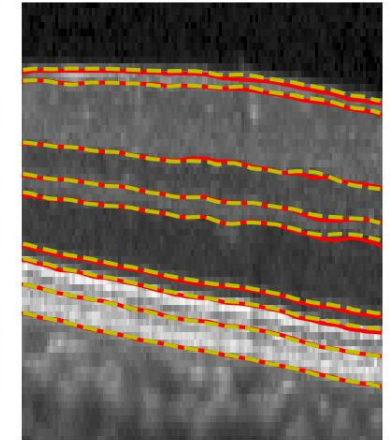
DSBM ODE



LMSB SDE



LMSB ODE



Conclusion



- We propose a latent metric Schrodinger bridge (LMSB) framework for OCT image harmonization.
- We demonstrate both theoretically and experimentally that LMSB achieves better performance in anatomy preservation than conventional Schrodinger bridges and other baseline methods.

Thank you!

