Conducting FPCA separately for each element of multivariate functional data can result in nonnegligible correlation between FPCA scores of each element. Therefore for our baseline method, we apply multivariate functional FPCA (Happ and Greven, 2018) to our bivariate functional data. To the best of our knowledge, there is no existing method that consider joint variation between bivariate functional data and scalar covariates.

References

Happ, C., Greven, S., 2018. Multivariate Functional Principal Component Analysis for Data Observed on Different (Dimensional) Domains. Journal of the American Statistical Association 113, 649–659. URL: https://doi.org/10.1080/01621459.2016.1273115, doi:10.1080/01621459.2016.1273115. publisher: Taylor & Francis _eprint: https://doi.org/10.1080/01621459.2016.1273115.