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A Conceptual Outlook on Gene Migration Analysis Using an Euler-Based Method

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Euler Characteristic Profiles (ECPs) [1] have recently gained attention within topological data analysis as a compact and computationally tractable descriptor of high-dimensional dynamical systems. In this talk, I outline an initial conceptual idea for applying ECPs to datasets related to gene migration and the movement of genetic information across populations. Rather than presenting definitive results, the aim is to discuss a possible framework in which population-level genetic variation is treated as a dynamic topological object whose evolving structure might be probed through ECP-based methods. Such an approach could, in principle, provide complementary perspectives on changes in genetic composition. The talk will therefore focus on the motivation, the theoretical rationale, and the open questions surrounding the adaptation of ECPs to population-genetic settings, with an emphasis on identifying potential challenges and directions for future investigation.

[1] P. Dłotko, D. Gurnari. Euler characteristic curves and profiles: a stable shape invariant for big data problem. *GigaScience* **12** (2023). https://doi.org/10.1093/gigascience/giad094