Development of an AI-Powered Powered Facial-cue Control Module

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This research started with the development of an app with customizable facial-cue based control. It led to a fundamental challenge at the center of all temporal data analytics: determining the degree of similarity between two data sequences in the presence of temporal distortions. The state-of-the-art method is Dynamic Time Warping (DTW), which is however too slow for real-time usage in multi-dimensional cases. This research, for the first time in about two decades, finds a solution that consistently outperforms the classic multivariate DTW algorithm across dataset sizes, series lengths, data dimensions, temporal window sizes, and machines. The new solution, named TC-DTW, creatively introduces Triangle Inequality and Point Clustering into the algorithm design. In experiments on DTW-based nearest neighbor finding, TC-DTW avoids as much as 98% (60% average) DTW distance calculations and yields as much as 25X (7.5X average) speedups. Its high speed removes barriers for many real-time uses of DTW, and accelerates scientific discoveries, medicine research, and many other fields driven by large amounts of temporal data. Its integration produces the first real-time customizable facial-cue control module with a response time within 100ms. The new algorithm has been adopted by researchers in Sepsis Shock diagnosis and Hurricane predictions.

Awards Won:

First Award of $5,000

Regeneron Young Scientist Awards

Association for Computing Machinery: Third Award of $1,500

NC State College of Engineering: Alternates

Association for the Advancement of Artificial Intelligence: Honorable Mention