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Poster
Deterministic AI models, aiming to produce a single definitive answer to a space weather (SW) forecasting problem, create a cognitive mismatch with human forecasters. Human forecasting is fundamentally statistical, informed by prior experience in which similar initial conditions have led to multiple plausible outcomes. Generative AI can be effective in realizing the statistical underpinning of the problem and creating a forecasting solution that is closer to the cognitive functioning of human forecaster.
We present a framework that can manipulate a solar active region (AR) along known physical trajectories using a generative model and use that manipulated image as a query to a self-supervised-learning (SSL) model for the retrieval of real matches from the past. To connect the physical space to abstract Generative model embedding space, we train a classifier to learn a decision boundary dividing embedding space into high and low values of physical parameters. We then manipulate ARs along directions normal to decision boundaries to produce ARs with desired physical properties, use those as queries to SSL and retrieve matching real ARs. We find visual and quantitative physical match between the generated query and the retrieved ARs. We then extract the known future of the retrieved ARs in terms of SW events (e.g., flares, CMEs, SEPs) to understand future possibilities for query AR. This approach elevates Generative AI from a synthetic data generator to a novel scientific data mining tool, acting as a helping hand for human forecasters to visualize and make a fair statistical judgment of the future.
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10
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