Note on Energy Matching and Energy Based Models for Generative Modeling

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# Introduction

Energy Matching is a unifying framework that combines the advantages of Flow Matching and Energy-Based Models, parameterized by a time-independent scalar potential field.

It explicitly encodes data likelihood information for controllable generation while keeping curvature low off-data for curl-free, efficient sampling.

The Claim: Energy Matching achieves SOTA performance among likelihood-based methods, on par with Diffusion and Flow Matching, unlocking exciting new inference-time capabilities.

# References

[1] [Energy Matching: Unifying Flow Matching and Energy-Based Models for Generative Modeling, Michal Balcerak et al, U of Zurich, 2025](https://github.com/dimitarpg13/information_theory_and_statistical_mechanics/blob/main/literature/articles/generative_models/Energy_Matching-Unifying_Flow_Matching_and_Energy-Based_Models_for_Generative_Modeling_Balcerak_2025.pdf)

[2] github repo: <https://github.com/m1balcerak/EnergyMatching>

[] [An Introduction to Flow Matching and Diffusion Models, Peter Holderrieth and Ezra Erives, Notes from MIT Class 6.S184, 2025](https://github.com/dimitarpg13/information_theory_and_statistical_mechanics/blob/main/literature/articles/generative_models/An_Introduction_to_Flow_Matching_and_Diffusion_Models_Holderrieth_MIT_2025.pdf)

[] [Flow Matching for Generative Modeling, Yaron Lipman et al, Meta FAIR, 2023](https://github.com/dimitarpg13/information_theory_and_statistical_mechanics/blob/main/literature/articles/generative_models/Flow_Matching_for_Generative_Modeling_Lipman_Meta_2023.pdf)

[] [Flow Straight and Fast: Learning to Generate and Transfer Data with Rectified Flow, X. Liu et al, 2022](https://github.com/dimitarpg13/information_theory_and_statistical_mechanics/blob/main/literature/articles/generative_models/Flow_Straight_and_Fast-Learning_to_Generate_and_Transfer_Data_with_Rectified_Flow_Liu_2022.pdf)

[] [Flow Matching Guide and Code, Yaron Lipman et al, 2024](https://github.com/dimitarpg13/information_theory_and_statistical_mechanics/blob/main/literature/articles/generative_models/Flow_Matching_Guide_and_Code_Lipman_2024.pdf)