

Changes Made

We have made the following changes since the NeurIPS 2025 submission, mostly based on the reviews received:

We have made several edits to Section 5:

1. We expanded Sec 5, renaming it from "Alternative Views" to "Alternative Views, Implementation Challenges, and Potential Solution".
2. Within Sec 5, we described the argument in each counter view in more detail so each of them are more critical and added additional views e.g. enabling Euclidean foundation models to learn geometric inductive bias through better data engineering and lack of connection between distortion and downstream performance at foundation model levels.
3. We then incorporated the content in Sec 4.4 to Sec 5, expanding the rebuttal for each alternative view and several actionable items that address the implementation challenges involved. We also incorporated more implementation challenges and potential solutions, such as emphasizing tailored training libraries and geometric optimization techniques.
4. For better organization of the additional texts, we re-organized the section into three subsections categorized by the overall theme of the views.

We have also made the following minor edits for clarity:

1. We expanded the end of Sec 2 to include additional citations.
2. We edited Sec 3.1 to make it more clear that Nash Embedding Theorem is not applicable.
3. We edited the introduction to emphasize that we are arguing for the collective community efforts for realizing large scale non-Euclidean foundation models
4. We edited Sec 3.1 to clarify how our results in Sec 3.2 reflect the scaling limitations of Euclidean foundation models discussed in Sec 3.1 and emphasize how embedding dimensions relate to model size and computational resource consumption.
5. We edited Sec 3.3 to clarify how orthogonal invariance from self-attention results in requirement of high dimensionality for Euclidean models.
6. We edited Sec 3.2 to make clear that we dismiss invariance from kernel designs to isolate the representational capacity of the spaces.
7. We edited Sec 4 to mention that non-Euclidean models can be evaluated with standard benchmarks and metrics.

Our *responses to the reviewers* are in the Author Survey responses in the NeurIPS reviews PDF.