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A Generative Geometry Foundation Model for Engineering Applications

Many scientific and engineering problems are fundamentally linked to geometry, for example, designing a part to maximise strength or modelling fluid flow around an airplane wing. Thus, there is substantial interest in developing machine learning models that can not only operate on or output geometric data, but generate new geometries. Such models have the potential to revolutionise advanced industries from materials manufacturing to medical imaging. However, constructing and training these models presents a range of novel challenges. In this talk, we will discuss a generative geometry model for aircraft, using it as a case study to illustrate some of these challenges and the approaches taken to tackle them. Among other topics, we shall consider how to encode geometry for ML, the difficulties of dataset curation, the advantages of geometric foundation models, and how to predict scalar and field properties of these geometries.

AI keywords

Generative Geometry Models; Geometric Deep Learning; Design Optimization; Functional Variational Autoencoders; Dataset Curation

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