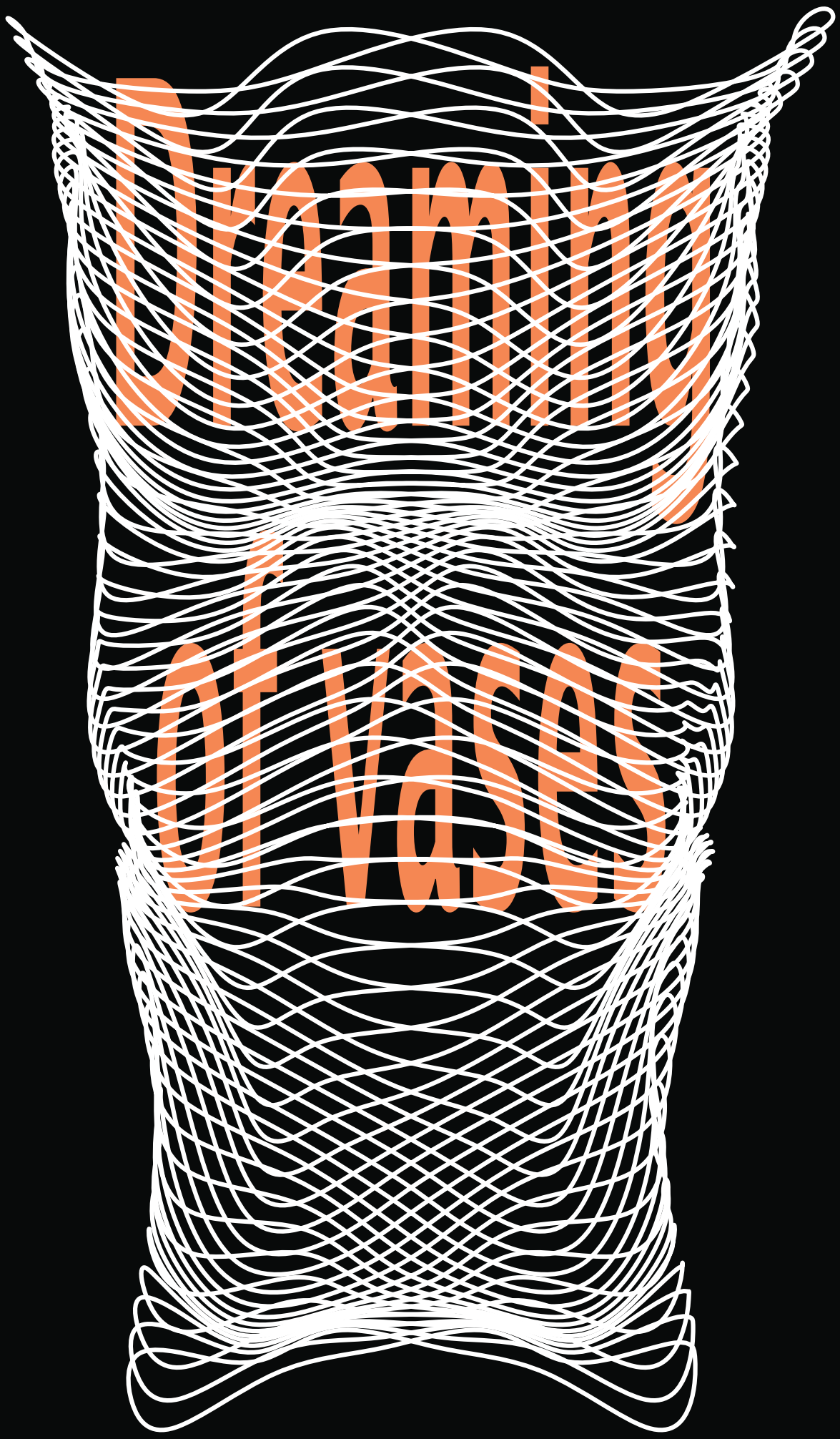
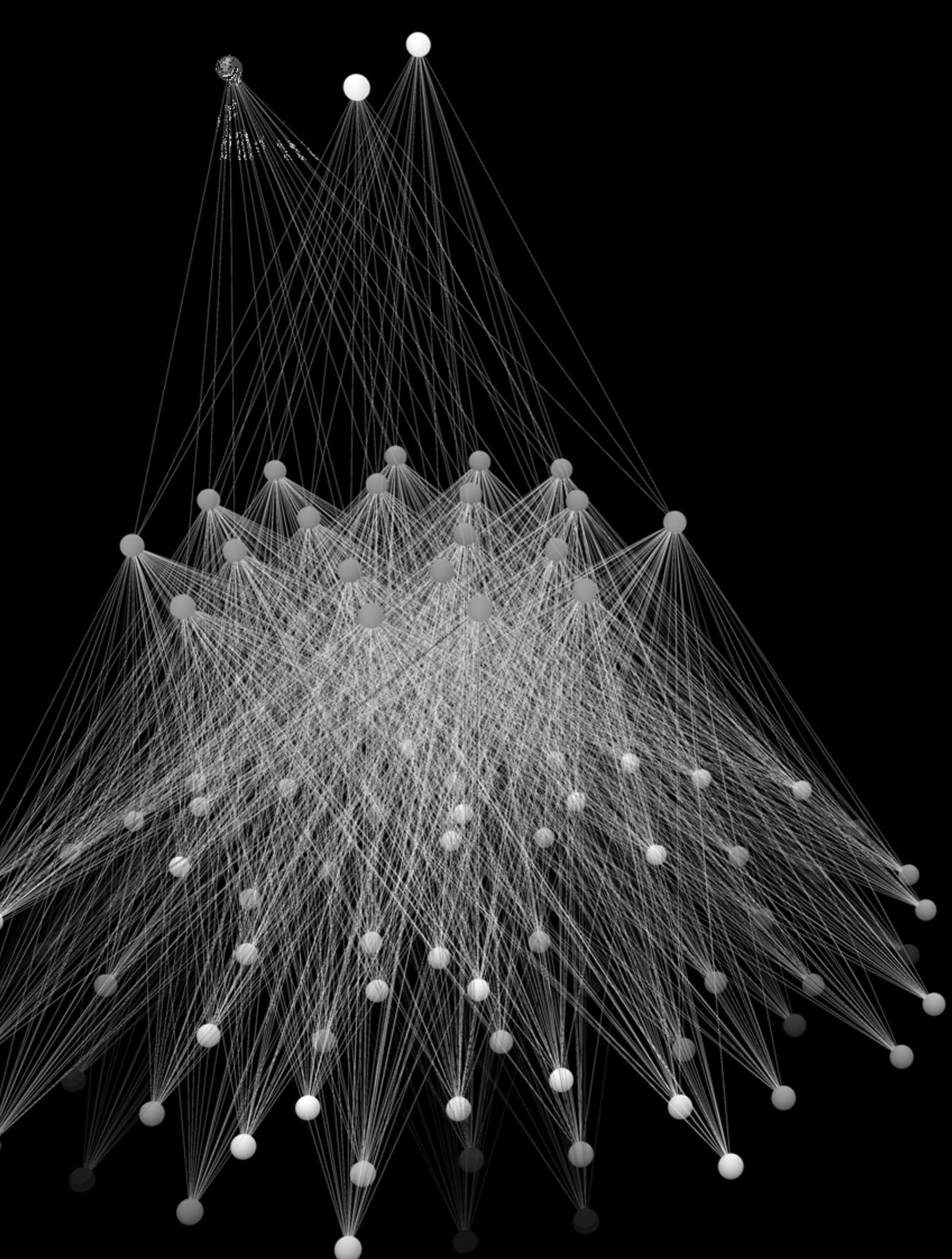
INN-B6 - QuoVadis - SoSe 2023 - Hesse



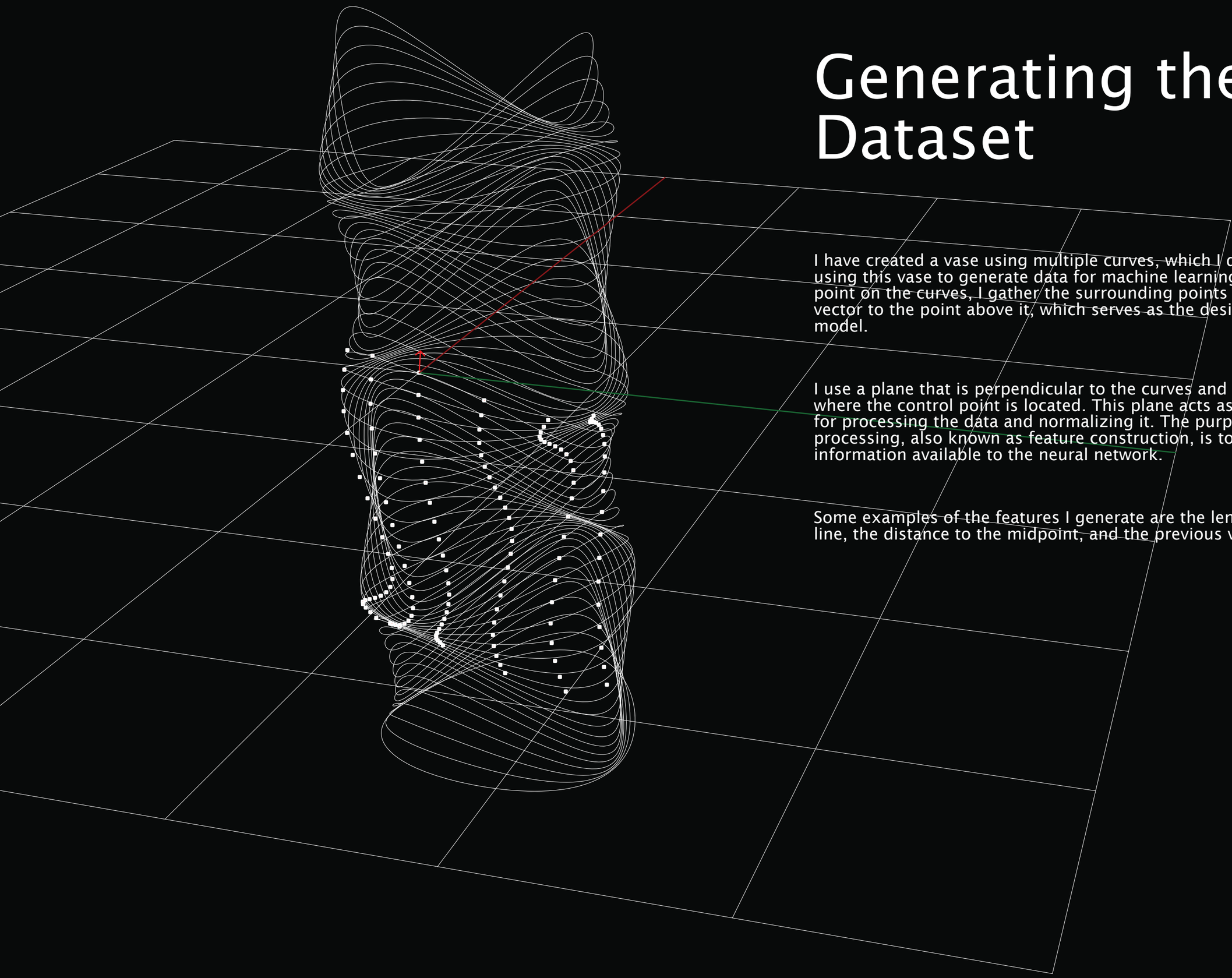


Introduction+Goal

In this project, we delve into a conglomerate of innovation topics and explore the possibilities and limitations for future design processes. We had to choose one of the three thematic areas: AI, Sustainable Materials, and Innovative Manufacturing Processes, and within this context, generate a piece of furniture or a spatial structure.

My intention is to leran about machine learning and gain knowledge about its concepts, techniques, and applications in the creative field.

The goal of my project is to train a machine learning model using a dataset of vase patterns and then utilize this trained model to generate dream-like extrapolations of how the vase could continue.

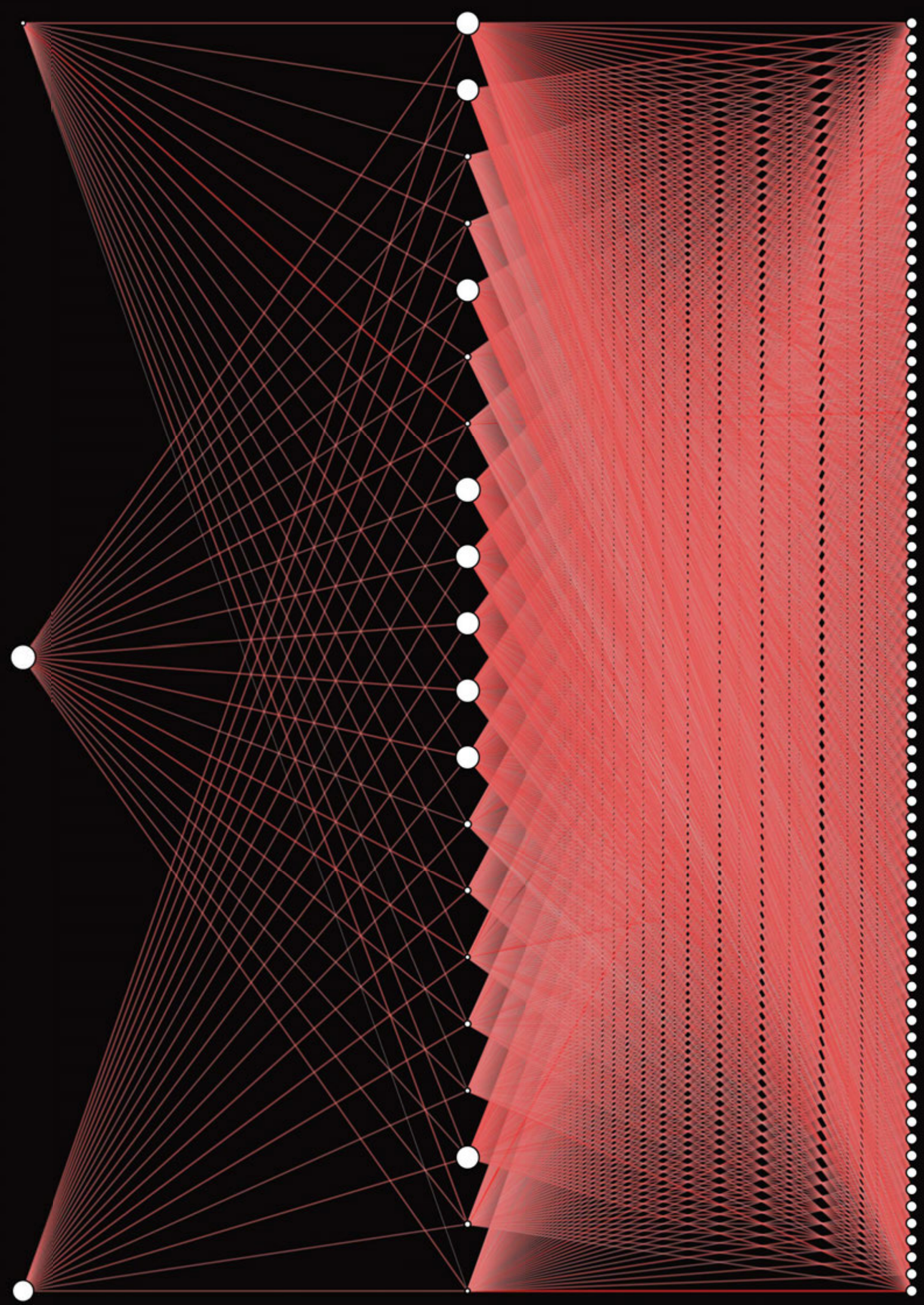


Generating the Dataset

I have created a vase using multiple curves, which I drew myself. I am using this vase to generate data for machine learning. For each control point on the curves, I gather the surrounding points below it and the vector to the point above it, which serves as the desired output for my model.

I use a plane that is perpendicular to the curves and has a zero point where the control point is located. This plane acts as a coordinate system for processing the data and normalizing it. The purpose of data processing, also known as feature construction, is to enhance the information available to the neural network.

Some examples of the features I generate are the length of the previous line, the distance to the midpoint, and the previous vectors.



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0.031877	0.145889	0.503449	0.871643	0.874128	0.503449	0.255471	0.173038	0.196682	0.122127
0.030248	0.145157	0.505387	0.875343	0.877602	0.505387	0.256463	0.173695	0.173038	0.091775
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0.027848	0.406781	0.552964	0.722378	0.770558	0.552964	0.389506	0.336056	0.300169	0.241327
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0.908782	0.785917	0.696141	0.832 1	0.785917	0.696141	0.691 57	0.699438	0.783422	0.847757
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0.838622	0.613539	0.406636	0.670148	0.613539	0.406636	0.476634	0.535747	0.409 5	0.603781
0.805 4	0.531888	0.242 8	0.575402	0.531888	0.242 8	0.351559	0.409 5	0.365235	0.551129
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0.797645	0.514113	0.203111	0.552054	0.514113	0.203111	0.320814	0.417701	0.505088	0.648768
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0.865533	0.679545	0.524196	0.736679	0.679545	0.524196	0.564733	0.602723	0.699438	0.787105
0.908782	0.785917	0.696141	0.832 1	0.785917	0.696141	0.691 57	0.699438	0.783422	0.847757
0.950318	0.887 4	0.847215	0.914692	0.887 4	0.847215	0.801361	0.783422	0.842431	0.890667
0.981602	0.964515	0.954191	0.972403	0.964515	0.954191	0.878315	0.842431	0.864 2	0.906498
0.993521	0.993611	0.993665	0.993569	0.993611	0.993665	0.906562	0.864 2	0.841416	0.889927
0.981 05	0.963166	0.952346	0.971413	0.963166	0.952346	0.876993	0.841416	0.782904	0.847382
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0.278483	0.406781	0.552964	0.722378	0.770558	0.552964	0.389506	0.336056	0.300169	0.241327
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0.160189	0.304388	0.541585	0.839884	0.874333	0.541585	0.30677	0.229974	0.265697	0.201679

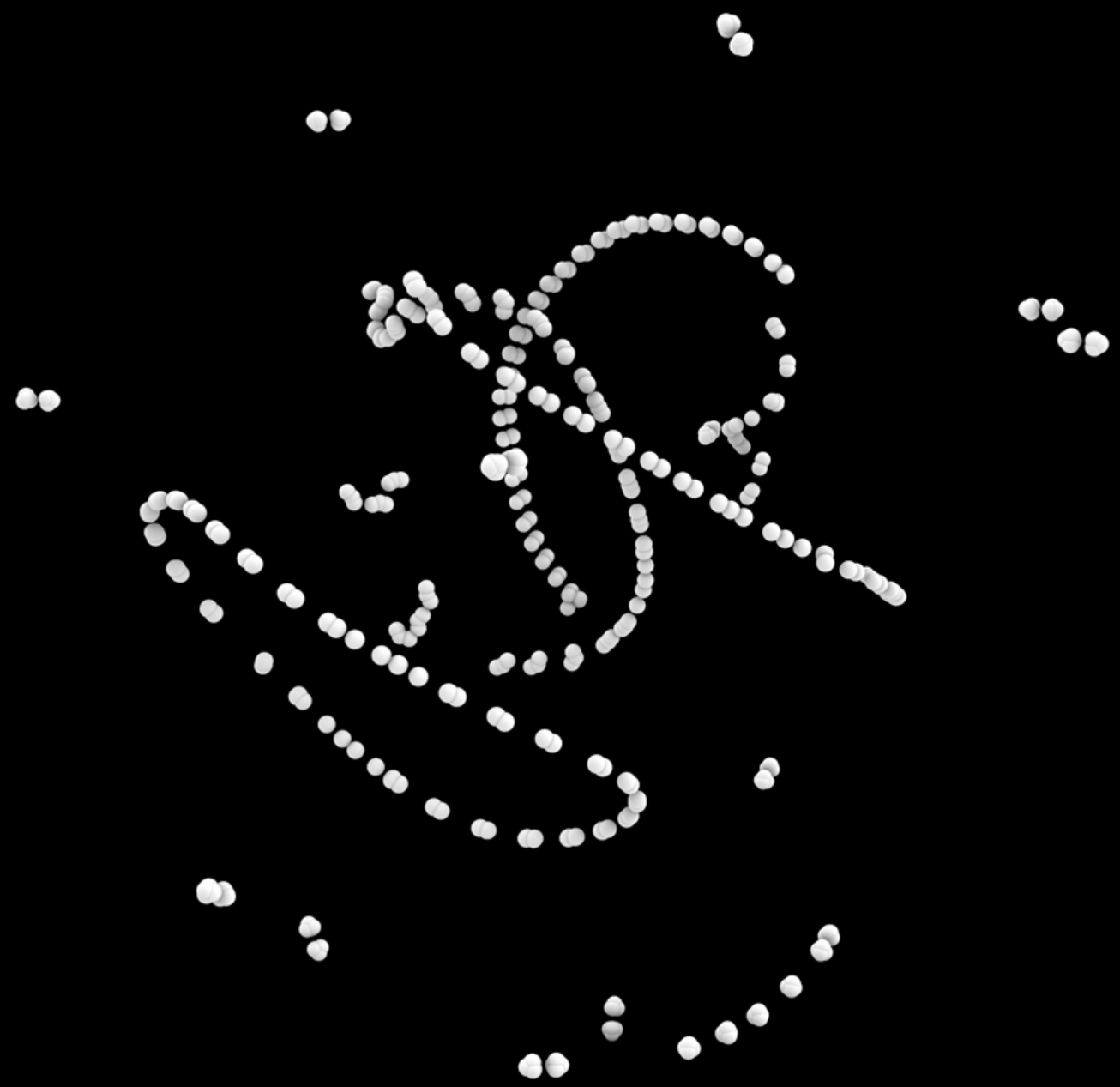
Growing Vases

I have collected multiple vases that were designed either with AI or by myself. To analyze these vases, I constructed features that capture their overall characteristics. Next, I utilized the t-SNE algorithm to reduce the dimensionality of the tensor set to three, which I then visualized in 3D space. Each point in the 3D space represents a vase.

To address gaps in the data where there were no points, I employed a technique of averaging the surrounding vases. The distance to the points served as weights for this averaging process. This approach allowed me to explore the data comprehensively and produced visually pleasing results. However, it involved computationally intensive tasks. Since it was not directly related to AI, I later adopted a different approach.

In the new approach, I utilized machine learning. I provided the 3 dimensions as inputs and expected the output to be the control points of the vase's curves. I trained the machine using this dataset. Subsequently, I incorporated the 3D position of the person navigating the space as the 3 dimensional tensorset and obtained a vase as the output. Although the results are not perfect, they are very interesting.

What fascinates me about this approach is that it transforms a low-dimensional tensor set into a high-dimensional tensor set. This implies that the AI is extrapolating and generating additional information, effectively hallucinating to some extentt



Point Universe

I have collected multiple vases that were designed either with AI or by myself. To analyze these vases, I constructed features that capture their overall characteristics. Next, I utilized the t-SNE algorithm to reduce the dimensionality of the tensor set to three, which I then visualized in 3D space. Each point in the 3D space represents a vase.

To address gaps in the data where there were no points, I employed a technique of averaging the surrounding vases. The distance to the points served as weights for this averaging process. This approach allowed me to explore the data comprehensively and produced visually pleasing results. However, it involved computationally intensive tasks. Since it was not directly related to AI, I later adopted a different approach.

In the new approach, I utilized machine learning. I provided the 3 dimensions as inputs and expected the output to be the control points of the vase's curves. I trained the machine using this dataset. Subsequently, I incorporated the 3D position of the person navigating the space as the 3 dimensional tensorset and obtained a vase as the output. Although the results are not perfect, they are very interesting.

What fascinates me about this approach is that it transforms a low-dimensional tensor set into a high-dimensional tensor set. This implies that the AI is extrapolating and generating additional information, effectively hallucinating to some extentt

Printing the Vases