GRASS: Generative Recursive Autoencoders for Shape Structures

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Motivation

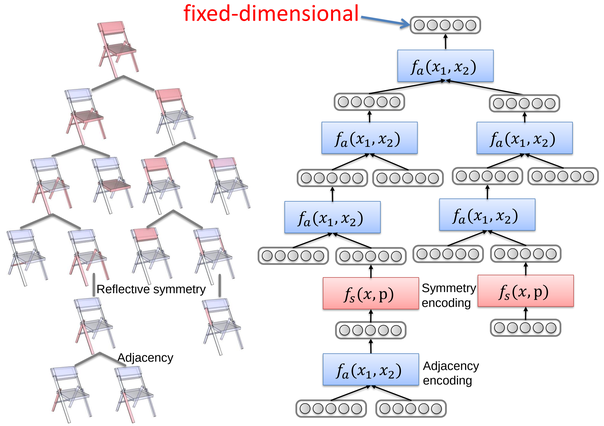
How can we capture

- Topological variation
- Geometric variation
- Hierarchical composition

of 3D shapes in a single, *generative*, *fixed-dimensional* representation?

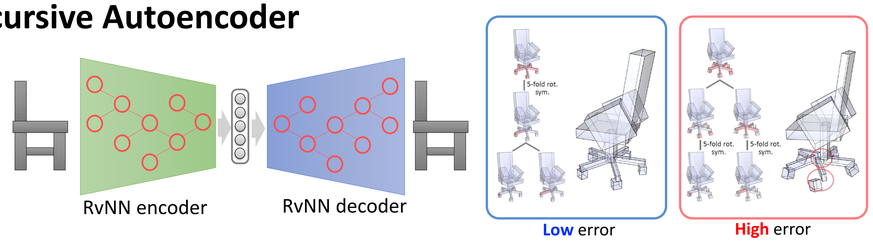
"Shape DNA" —decode→ Generate

Structure encoding by Recursive Neural Network (RvNN)



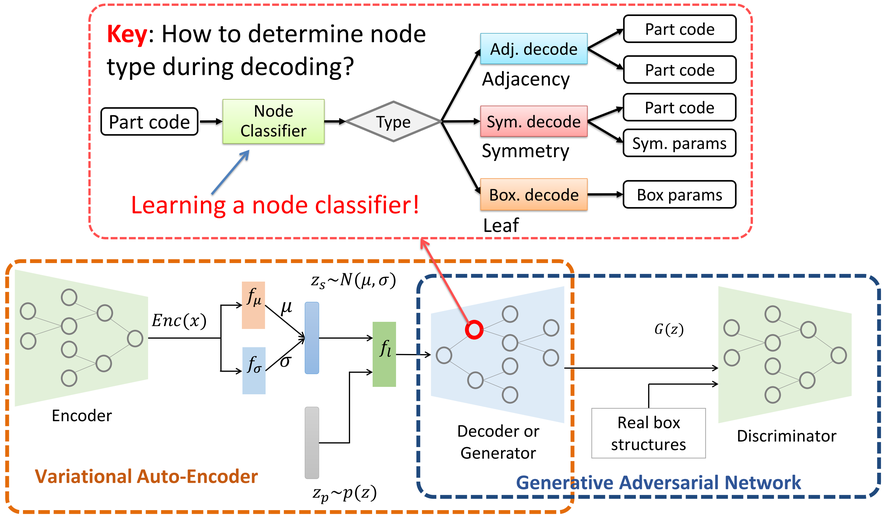
Make It Generative!

Recursive Autoencoder



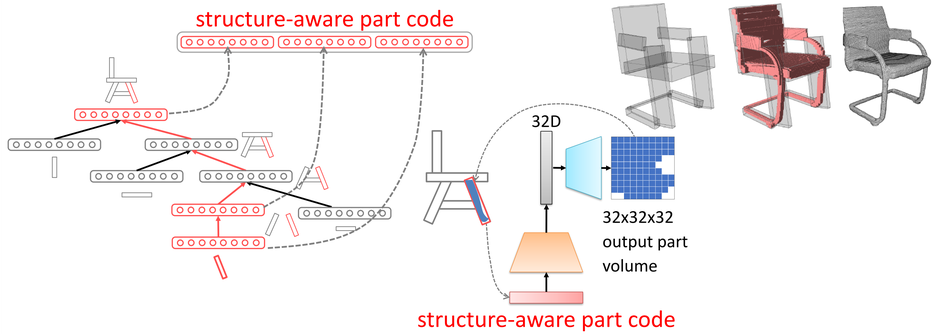
Learn a *deterministic* generative model to find the right hierarchy for structure encoding – The hierarchy that gives the lowest self-reconstruction error.

VAE-GAN



Learn a *probabilistic* generative model to generate novel 3D shape structures – A hierarchy of cuboids encompassing parts and their relationships.

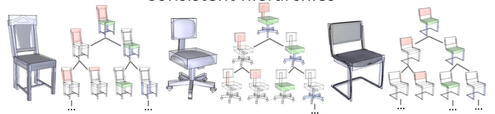
Part Geometry Synthesis



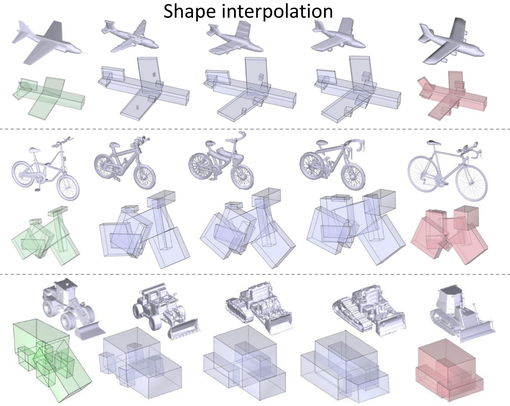
Learn a neural network to map the structure-aware part code of a part into a 3D volumetric representation of its part geometry.

Results

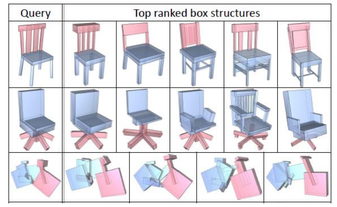
Consistent hierarchies



Shape interpolation



Partial structure retrieval



Shape synthesis