Learning Topology and Geometry
Automated Grammar Induction

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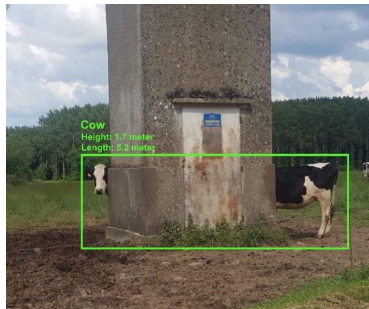
22 August 2022

Critiques of DL/NN recently circulating on social media

Triangulations, cycles, cocycles, universal covering groups, metrics
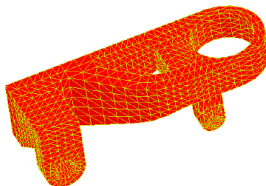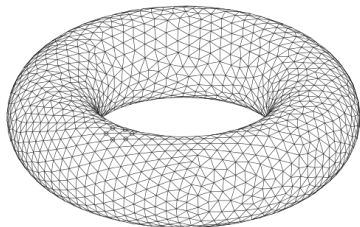
Deep and broad mathemaical foundations to draw on.

Learning Topology and Geometry

Jigsaws, plus "global" constraints such as must-form-a-cycle
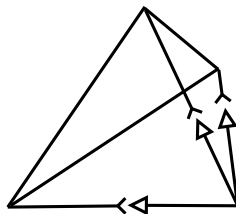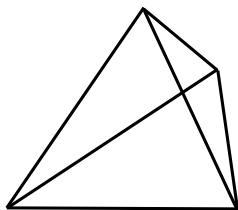
Not quite graph theory.
Not quite relational algebra.
... but almost so.

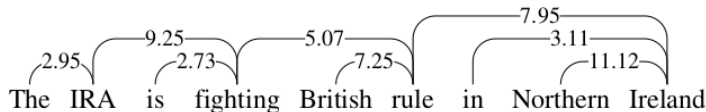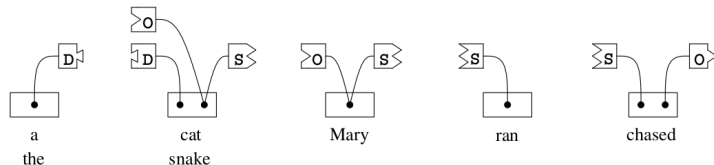Image segmentation as labelled geometric relationships
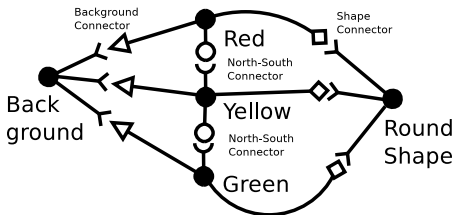
Geometric syntax encodes part–whole relationships!

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Jigsaw Paradigm Established in Linguistics

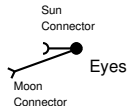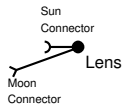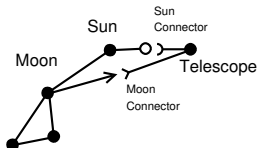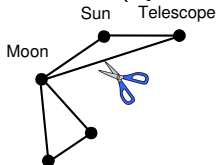Syntax in Link Grammar (1991) and earlier (Marcus, 1967)

Maximum Spanning Tree parse from Word-Pair MI (1998)

Learning Topology and Geometry
Provides Semantics for Symbolic AI
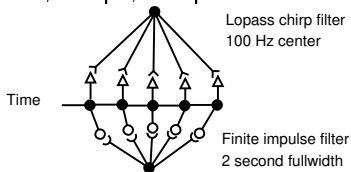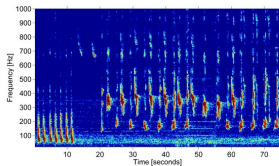
Abstract (Symbolic AI) "Things that can be seen"

Syntax extending into shallow semantics

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Audio: frequency, intensity, time, shape, chirp modulation, wavelets
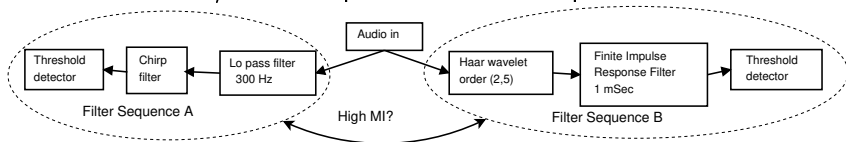

Syntax and structure of a whale song

Learning Topology and Geometry
Segmentation and Tokenization as (evolutionary, ML) Program Learning

Conventional ML/AI can explore DSP filter sequences

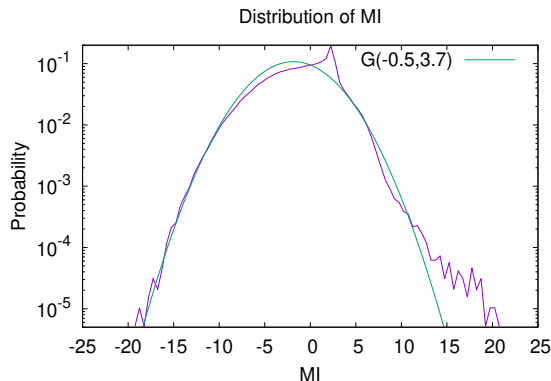Can DL/NN be used to generate these?
Possibly ... probably. Not been done.
Recursive... (model->syntax->model->syntax...)
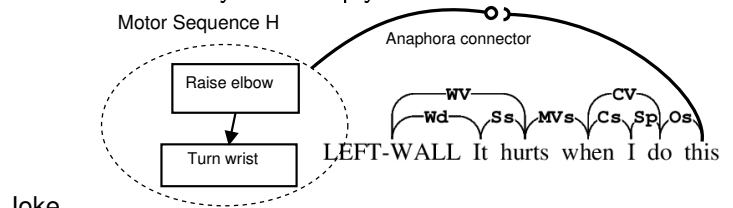... and deep ("cheap").

Gaussian Orthogonal Ensemble (Spin Glass)

Distribution of MI

Uniform distribution of English word similarities in high dimensions.
Conventional (information-theoretical) metrics apply.

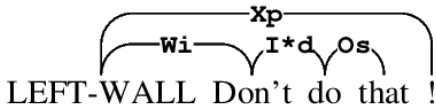Enactive AI founded on unsupervised symbolic relationships,
Learned recursively i.e. "deeply"

GOFAI failed because it depended on human-curated datasets.
This proposal doesn't.
... and it was shallow. Shallow==hard-to-learn.