Learning to Learn with Compound HD Models

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Hierarchical-Deep Models

**HD Models:** Integrate hierarchical Bayesian models with deep networks.

**Hierarchical Bayes:**

- Learn **hierarchies of categories** for sharing abstract knowledge.
- Explicitly **share parameters** that are relevant to learning new concept.

**Deep Networks:**

- Learn **hierarchies of features**.
- **Unsupervised feature learning** – no need to rely on human-crafted input features.
- **Distributed representations**.
Hierarchical Generative Model

Tree hierarchy of classes is learned

"animal"  "vehicle"

z \sim \text{nCRP (Nested Chinese Restaurant Process)}

prior: a nonparametric prior over tree structures

h^3 | z \sim \text{HDP (Hierarchical Dirichlet Process)}

prior: a nonparametric prior allowing categories to share higher-level features, or parts.

v | h^3 \sim \text{DBM Deep Boltzmann Machine}

Enforce (approximate) global consistency through many local constraints.

Images, Handwritten characters, Motion capture datasets.
Learning to Learn from Few Examples

Learning from 3 examples

Training Examples (by row)

Conditional Samples

Generating Novel Characters

Learned Super-Classes (by row)

Sampled Novel Characters