One Shot Learning via Compositions of Meaningful Patches

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motivation
Current state-of-the-art algorithms perform very well on most common datasets when trained on thousands of examples. However, humans are able to learn a concept from very few examples, perhaps even just one.

what is one shot learning?
One shot learning is an object categorization task where very few examples (1-5) are given for training.

our approach
• Learn a meaningful patch-based representation of the underlying structure of an object without human supervision
• Build a compositional model composed of a set of compact dictionaries of meaningful patches
• Reconstruct the target image with deformations of the meaningful patch dictionaries by patch matching
• Select the class of the best proposed reconstruction as label

compositional model
• Similar parts, defined by a high match score via Normalized Cross Correlation, are merged to create a compact dictionary
• An AND-OR graph of the part relations is construction for m patches for samples i and u:
  \[ S_i^u = (R_i^1 \lor R_i^2) \land \ldots \land (R_i^k \lor \ldots \land (R_i^m \lor R_u^m)) \]
• Deformations are applied to the meaningful patches

experimental results
Our compositional model outperforms popular algorithms on the recognition task under one shot learning.

sample reconstructions

conclusion
• Our compositional model outperforms popular algorithms on the recognition task under one shot learning
• The extracted features are semantically meaningful
• The model generalizes beyond the training set and demonstrates transferability between separate datasets

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*Left image denotes test image, right image denotes reconstruction