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Semantic Entity Retrieval Toolkit

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ABSTRACT
Unsupervised learning of low-dimensional, semantic representations of words and entities has recently gained attention. In this paper we describe the Semantic Entity Retrieval Toolkit (SERT) that provides implementations of our previously published entity representation models. The toolkit provides a unified interface to different representation learning algorithms, fine-grained parsing configuration and can be used transparently with GPUs. In addition, users can easily modify existing models or implement their own models in the framework. After model training, SERT can be used to rank entities according to a textual query and extract the learned entity/word representation for use in downstream algorithms, such as clustering or recommendation.

KEYWORDS
Neural information retrieval; Entity retrieval; Toolkit

1 INTRODUCTION
The unsupervised learning of low-dimensional, semantic representations of words and entities has recently gained attention for the entity-oriented tasks of expert finding [9] and product search [8]. Representations are learned from a document collection and domain-specific associations between documents and entities. Expert finding is the task of finding the right person with the appropriate skills or knowledge [1] and an association indicates document authorship (e.g., academic papers) or involvement in a project (e.g., annual progress reports). In the case of product search, an associated document is a product description or review [8].

In this paper we describe the Semantic Entity Retrieval Toolkit (SERT) that provides implementations of our previously published entity representation models [8, 9]. Beyond a unified interface that combines different models, the toolkit allows for fine-grained parsing configuration and GPU-based training through integration with Theano [3, 6]. Users can easily extend existing models or implement their own models within the unified framework. After model training, SERT can compute matching scores between an entity and a piece of text (e.g., a query). This matching score can then be used for ranking entities, or as a feature in a downstream machine learning system, such as the learning to rank component

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Apart from entity ranking, the learned representations and model-specific parameters can be extracted conveniently from the models through the interface\(^2\) and used for down-stream tasks such as clustering, recommendation and determining entity importance as shown in [10].

3 CONCLUSIONS

In this paper we described the Semantic Entity Retrieval Toolkit, a toolkit that learns latent representations of words and entities. The toolkit contains implementations of state-of-the-art entity representations algorithms [8, 9] and consists of three components: text processing, representation learning and inference. Users of the toolkit can easily make changes to existing model implementations or contribute their own models by extending an interface provided by the SERT framework.

Future work includes integration with Pyndri [11] such that document collections indexed with Indri can transparently be used to train entity representations. In addition, integration with machine learning frameworks besides Theano, such as TensorFlow and PyTorch, will make it easier to integrate existing models into SERT.

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**Code snippet 1**: Illustrative example of the SERT model interface. The full interface supports more functionality omitted here for brevity. Users can define a symbolic graph of computation using the Theano library [6] in combination with Lasagne [3].

```python
class ExampleModel(VectorSpaceLanguageModelBase):
    def __init__(self, *args, **kwargs):
        super(ExampleModel, self).__init__(
            *args, **kwargs)

        # Define model architecture.
        input_layer = InputLayer(
            shape=(self.batch_size, self.window_size))

        # Compute symbolic loss between predicted/actual entities.
        self._finalize(loss_fn, ...)

    def loss_fn(pred, actual, _):
        # The framework deals with underlying boilerplate.
        self._finalize(loss_fn, ______)

    def get_representations(self):
        # Returns the representations and parameters to be extracted.
```

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2\(^2\)See get\(\_\)representations in Snippet 1.