UN/SEMI SUPERVISED SOLUTION BASED
NLP ARCHITECT

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Python library for exploring the state-of-the-art deep learning topologies and techniques for NLP:

- Developed as a NLP models platform
- Include state-of-art research
- Showcase Intel Optimized frameworks (Tensorflow, MKL-DNN)

Github.com/NervanaSystems/nlp-architect
NLP ARCHITECT 0.3 FEATURES

• 15 NLP/NLU components and End-to-end models, 2 solutions

• Main library features:
  • Datasets and datasets loaders
  • Models
  • DL framework extensions (tensorflow, tf.keras, Dynet)
  • Misc. utils - IO/metrics/embeddings/etc.
  • REST API server and demo UI

• REST server:
  • Simple demo frontend
  • Dependency parser, NER, Intent Extraction, Machine reading comprehension demos
  • Extensible - users can add own model

• Example per model, extensive documentation, publications, jupyter tutorials - LINK
NLP Architect by Intel® AI Lab

Release: 0.2
Date: Aug 14, 2018

NLP Architect is an open-source Python library for exploring the state-of-the-art deep learning topologies and techniques for natural language processing and natural language understanding. It is intended to be a platform for future research and collaboration.

The library includes our past and ongoing NLP research and development efforts as part of Intel AI Lab.

NLP Architect can be downloaded from Github: https://github.com/NervanaSystems/nlp-architect

How can NLP Architect be used

- Train models using provided algorithms, reference datasets and configurations
- Train models using your own data
- Create new/extend models based on existing models or topologies
- Explore how deep learning models tackle various NLP tasks
- Experiment and optimize state-of-the-art deep learning algorithms
- Integrate modules and utilities from the library to solutions

Library Overview

Research driven NLP/NLU models
Easy to build and deploy NLP-DL applications for the real world

“NLP Architect Vison”
NLP Architect for Solutions

**NLP Stack**
- NLP use cases
- NLP applications
- NLP Components
- Topologies
- Layers/Compute Ops
- Tools (NGRAPH™, TENSORFLOW, etc.)
- Hardwares

**NLP Solutions**
- Topic Analysis
- Sentiment Analysis
- Translation
- Dialogue System
- Machine Reading
- Text Summarization
- Relation Extraction
- Trend Analysis

**Business Insights**
- Product Review
- Customer Relationship Management
- Competitive Intelligence
- Root Cause Analysis
- Branding and Messaging
- Knowledge Management
Intent extraction is a type of Natural-Language-Understanding (NLU) task that helps understand the type of action (intent) conveyed in sentences and tokens contributing to the understanding of the scenario. The mode is based on a multi-task Bi-LSTM model with CRF classifier.
Customer Interaction Example

please stop my TV-TV subscription

Do you wish to cancel this service?

Yes

Is there any particular reason?

It's very slow, not what I had intended for it to be used for.

<table>
<thead>
<tr>
<th>Event</th>
<th>Cancel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>TV-TV</td>
</tr>
<tr>
<td>Reason</td>
<td>Very slow</td>
</tr>
</tbody>
</table>
Named Entity Recognition (NER) is a basic information extraction task in which words (or phrases) are classified into predefined entity groups. The model is based on a multi-task Bi-LSTM model with CRF classifier.

Example sentences:
- Michael Jackson was a famous US musician

Enter sentence or select an example:
- Michael Jackson was a famous US musician

Result:
- Michael Jackson **PER** was a famous **US** **LOC** musician
CHALLENGES IN DEPLOYING NLP

- Dealing with small amount of data
- Need a large team of domain experts and very time consuming
- Hard to scale solutions across different domains
- No adaptation to business environment
TAXONOMY BUILDER: NON EXPERT TOOL

Select input corpus (1) → Train models (2) → Select seed set (3) → Expand seed set (4) → Edit & validate (5) → List of terms of a fine grained semantic class

Unsupervised learning

Siri, Alexa

Expand a given partial set of terms into a more complete set of terms that belong to the same semantic class

- Google Now
- EVA
- Cortana
- Erica
**DEMO – Skills Expansion from CVs**

- **Machine Learning**
- **AI network**
- **Pattern recog.**
- **Data Mining**
- **DNN**
- **NLP**
- **CNN**

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The example demonstrates how skills expansion can be achieved from CVs using related terms. The table shows the scores for each term related to the input term 'Machine learning'. The scores are calculated based on relevance, and the top results are displayed.

<table>
<thead>
<tr>
<th>#</th>
<th>Results</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>artificial neural networks</td>
<td>0.84870</td>
</tr>
<tr>
<td>1</td>
<td>pattern recognition</td>
<td>0.84576</td>
</tr>
<tr>
<td>2</td>
<td>data mining</td>
<td>0.84427</td>
</tr>
<tr>
<td>3</td>
<td>deep neural networks</td>
<td>0.84277</td>
</tr>
<tr>
<td>4</td>
<td>natural language processing</td>
<td>0.83963</td>
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<tr>
<td>5</td>
<td>convolutional neural networks</td>
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</tr>
<tr>
<td>6</td>
<td>neural networks</td>
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<tr>
<td>7</td>
<td>machine learning techniques</td>
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</tr>
<tr>
<td>8</td>
<td>data visualization</td>
<td>0.81890</td>
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<tr>
<td>9</td>
<td>big data analysis</td>
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<tr>
<td>10</td>
<td>visual analytics</td>
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<tr>
<td>14</td>
<td>machine learning methods</td>
<td>0.80748</td>
</tr>
</tbody>
</table>
LEVELS OF SENTIMENT ANALYSIS

1. **Sentence based SA**
2. **Aspect based SA**

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**I think that the screen size is small**

*opinion holder*

- sentiment target/aspect
- sentiment term

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**Customer's Sentiment Report**

<table>
<thead>
<tr>
<th>Amount (#)</th>
<th>Weight</th>
<th>CPU performance</th>
<th>Screen size</th>
<th>Battery size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>150</td>
<td>100</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>negative</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

- Positive
- negative
CHALLENGE: SENTIMENT DOMAIN SENSITIVITY

- “fuzzy teddy bear” Vs. “fuzzy Camera”

- “the movie is unpredictable” Vs. “the market/interest rate is unpredictable”

- “within a month a valley has formed in the middle of the mattress”
UNSUPERVISED ASPECT-BASED SENTIMENT ANALYSIS

- Unsupervised expansion of sentiment lexicons using aspects and re-ranking of sentiment terms
- Released in next version