Penman

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An Open-Source Library and Tool for AMR Graphs

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Introduction

If you work with Abstract Meaning Representation, consider the Penman package for both Python and command-line usage:

- Reads and writes AMR graphs
- Inspects, constructs, and manipulates trees and graphs
- Reformats for consistency
- Restructures and normalizes graphs
- Validates graphs with a semantic model

Introduction

Furthermore, it is:

- Well-tested
- Well-documented
- Under a permissive open-source license (MIT)

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Abstract Meaning Representation

(1) I swam in the pool today.

```
(s / swim-01
   :ARG0 (i / i)
   :location (p / pool)
   :time (t / today))
```


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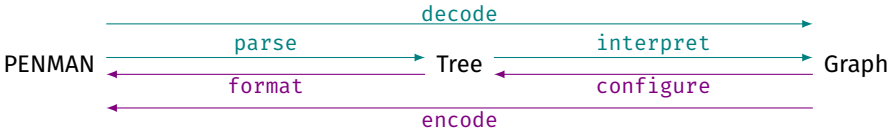
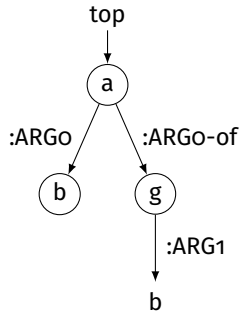
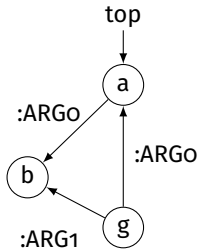
Decoding and Encoding Graphs




```
(a / alpha
   :ARG0 (b / beta)
   :ARG0-of (g / gamma
      :ARG1 b))
```





Using the penman Command

Demo

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Using the penman Command

Start with an example file:

```
$ cat ex.txt
(w / want-01 :polarity - :ARG0 (t / they) :ARG1 (g / go-02 :ARG0 t))
```

You can pipe the contents to penman to reformat:

```
$ cat ex.txt | penman
(w / want-01
   :polarity -
   :ARG0 (t / they)
   :ARG1 (g / go-02
            :ARG0 t))
```


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Simple Reformatting (Command)

You can also give it a file argument and formatting options:

```
$ penman ex.txt --indent 3 --compact
(w / want-01 :polarity -
   :ARG0 (t / they)
   :ARG1 (g / go-02
      :ARG0 t))
```

Or view the graph as a triple conjunction:

```
$ penman ex.txt --triples
instance(w, want-01) ^
polarity(w, -) ^
ARG0(w, t) ^
instance(t, they) ^
ARG1(w, g) ^
instance(g, go-02) ^
ARG0(g, t)
```

Tree Operations (Command)

Rearrange the branches of the tree structure:

```
$ penman ex.txt --rearrange=random
(w / want-01
   :ARG0 (t / they)
   :ARG1 (g / go-02
            :ARG0 t)
   :polarity -)
```

Relabel the nodes:

```
$ penman ex.txt --make-variables='a{i}'
(a0 / want-01
    :polarity -
    :ARG0 (a1 / they)
    :ARG1 (a2 / go-02
              :ARG0 a1))
```


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Using Models (Command)

Check for model validity (–amr uses the AMR model):

```
$ penman ex.txt --amr --check
(w / want-01
   :polarity -
   :ARG0 (t / they)
   :ARG1 (g / go-02
            :ARG0 t))
$ sed 's/:polarity/:polar/' ex.txt | penman --amr --check
# ::error-1 (w :polar -) invalid role
(w / want-01
   :polar -
   :ARG0 (t / they)
   :ARG1 (g / go-02
            :ARG0 t))
```

Graph Operation (Command)

Reify edges to nodes or reconfigure the graph:

```
$ penman ex.txt --amr --reify-edges
(w / want-01
   :ARG1-of (_ / have-polarity-91
               :ARG2 -)
   :ARG0 (t / they)
   :ARG1 (g / go-02
            :ARG0 t))
$ penman ex.txt --amr --reconfigure=random
(w / want-01
   :ARG0 (t / they
            :ARG0-of (g / go-02))
   :polarity -
   :ARG1 g)
```


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Using penman in Python

Demo

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Loading and Inspecting Data (API)

The Python API can do some things the `penman` command cannot, such as graph inspection.

```
>>> import penman
>>> amrs = penman.load('ex.txt')  # load returns a list
>>> amrs[0]
<Graph object (top=w) at 140705147194816>
>>> for triple in amrs[0].triples:
...     print(triple)
...
('w', ':instance', 'want-01')
('w', ':polarity', '-')
('w', ':ARG0', 't')
('t', ':instance', 'they')
('w', ':ARG1', 'g')
('g', ':instance', 'go-02')
('g', ':ARG0', 't')
```

More Data Inspection (API)

The graph properties can be inspected individually:

```
>>> amrs[0].top
'w'
>>> amrs[0].variables()
{'g', 't', 'w'}
>>> [inst.target for inst in amrs[0].instances()]
['want-01', 'they', 'go-02']
>>> amrs[0].reentrancies()  # variables mapped to number of reentrancies
{'t': 1}
```


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Manipulation (API)

Or edited:

```
>>> amrs[0].triples.remove(('w', ':polarity', '-'))
>>> amrs[0].triples.extend([
...   ('g', ':ARG4', 'p'),
...   ('p', ':instance', 'park')])
>>> amrs[0].metadata['snt'] = 'They want to go to the park.'
>>> print(penman.encode(amrs[0]))
# ::snt They want to go to the park.
(w / want-01
   :ARG0 (t / they)
   :ARG1 (g / go-02
            :ARG0 t
            :ARG4 (p / park)))
```

Removing Senses (API)

A longer example: removing sense suffixes to reduce sparsity

```
>>> import re
>>> sense = re.compile(r'-\d+($|~)')
>>> def desense(branch):
...     role, tgt = branch
...     if role == '/':
...         tgt = sense.sub(r'\1', tgt)
...     return role, tgt  # modified target
...
>>> t = penman.parse('(s / swim-01~e.1 :ARG0 (i / i))')
>>> for _, branches in t.nodes():
...     branches[:] = map(desense, branches)
...
>>> print(penman.format(t))
(s / swim~e.1
   :ARG0 (i / i))
```


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Conclusion

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Penman is open source (MIT) and easy to get:

Install the latest version from PyPI:

- `pip install penman`

Read the documentation:

- `https://penman.readthedocs.io/`

Contribute to Penman:

- `https://github.com/goodmami/penman`

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Thanks!