Introduction to the CLTK

June 8, 2016

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http://cltk.org

Linking the Big Ancient Mediterranean
University of Iowa, June 6-8, 2016
#BAM2016
The CLTK’s goals ...

- **Low**: Good datasets for NLP of ancient languages (Egyptian hieroglyphs, Ancient Greek, Latin, Hebrew, Sanskrit, Tibetan, Classical Chinese, etc.)
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- **Medium**: Quantified Classics
The CLTK’s goals …

- **Low**: Good datasets for NLP of ancient languages (Egyptian hieroglyphs, Ancient Greek, Latin, Hebrew, Sanskrit, Tibetan, Classical Chinese, etc.)
- **Medium**: Quantified Classics
- **High**: Framework for an integrated study of the ancient world
... for a connected ancient world
By the numbers

- Began 2014
- 1,523 commits
- 24 contributors
- 27 watchers, 103 stars, 80 forks
- 39 people, 18 teams
- 24 releases (with DOI for every release)
- 81% code coverage
- Supports POSIX OS (and partially Windows)
- 2 students, Google Summer of Code
  - Patrick Burns, PhD (ISAW)
  - Suhaib Khan (Netaji Subhas Institute of Technology, Delhi, India); mentored by Luke Hollis of Archimedes Digital)
Some basic terms

- Python: A programming language known for its easy-to-read syntax and general friendliness
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- **Python**: A programming language known for its easy-to-read syntax and general friendliness
- **NLP**: Natural language processing
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- **NLTK**: A prominent NLP package for the Python language
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- Python: A programming language known for its easy-to-read syntax and general friendliness
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- Git: Software for distributed software development
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- **GitHub**: A website which makes Git easy
- **Jupyter (formerly IPython)**: “Scientific notebooks”, an easy way to share code
Explore open classical literature

Search...

READ CLASSICAL WORKS IN GREEK, LATIN, CHINESE, COPTIC, AND PALI
AND RESEARCH METADATA ON YOUR FAVORITE TEXTS.
Get Started

BROWSE POPULAR AUTHORS, POETS, AND HISTORIANS

poemata
catullus

washingtonii_vita
glass

bellum_catilinae
sailust

jugurtha
sailust

agricola
tacitus

annales
tacitus
1

Cui dono lepidum novum libellum

Cui dono lepidum novum libellum

arido modo pumice expolitum?

Corneli, tibi; namque tu solebas
1.1: How, Wells - 1902

THE opening sentence embodies the title in the work. Cf. the opening words of Hecataeus (fr. 332) 'Ε Ἔλληνας ἦδη μιθρᾶται and Thuc. i. i. 1. Θορίην (vid. opp. crit.) seems to have been the usual reading at the end of the fourth century (cf. Duris of Samos, fr. 57, F. H. G. ii. 482). Plutarch (Mor. 605) writes Χ. Ἀλκιμανδρεύς Ἰστορίας.

1.1: How, Wells - 1902

οἱ λόγοι (= ‘skilled in history’) cf. ii. 3. 1. H.’s story is decidedly Greek, and not Persian, in colouring; cf. vi. 54; vii. 150. 2 a like (supposed) Persian acquaintance with Greek myths; a similar knowledge is attributed to the Egyptians ii. 91. 5. Such combinations certainly come from Greek sources, not native ones.

1.2: How, Wells - 1902

The pre-eminence of Argos in early times is an inference from Homer, and even more from the
catullus

poemata

no lepidum novum libellum

no lepidum novum libellum

nodo pumice expolitum?

hi, tibi; namque tu solebas
CLTK API

```json
{"language": "latin", "authors": ["plato", "tacitus", "vergil", "catullus", "sallust"]}
```
Design principles

Disintermediation
- Independent of academic bureaucracy
- Software direct into researchers’ hands
### Design principles

<table>
<thead>
<tr>
<th>Disintermediation</th>
<th>Decentralization</th>
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Transparency
- Public development on GitHub
- Public, readable code
## Design principles

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<tr>
<td>Standardization</td>
<td>● Scientific reproducibility</td>
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<td>● Good basic texts, but editable</td>
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Design principles

Extensibility

- Accepting of any proven NLP algorithms
- 100% NLP coverage of all ancient langs
Design principles

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  - Accepting of any proven NLP algorithms
  - 100% NLP coverage of all ancient langs

- **Multi-disciplinary**
  - Academic depts, CS, faith traditions
  - Intersection of industry & academe

- **Mutual benefit**
  - Full public record of all commits
  - Researchers develop own work
## Design principles

| Extensibility                  | • Accepting of any proven NLP algorithms  
|                               | • 100% NLP coverage of all ancient langs |

| Multi-disciplinary            | • Academic depts, CS, faith traditions  
|                               | • Intersection of industry & academe |

| Mutual benefit               | • Full public record of all commits  
|                               | • Researchers develop own work |

| Inclusion                    | • Collaborative, encouraging  
|                               | • Free, easy communication |
Design principles

Free & open source

- Fork, modify, merge … whatever!
- MIT licence (OK for commercial use)
Scientific method and communication

1. Make observations
2. Think of interesting questions
3. Formulate hypotheses
4. Develop testable predictions
5. Gather data to test predictions
6. Develop general theories
(repeat)
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2. Documentation
3. Reproducibility
   ○ Archiving
   ○ Data sharing
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   ○ Archiving
   ○ Data sharing

Data sets should be:
- Versioned
- Author-attributed
- Auditable
- Editable
- Easily obtained
Technical organization: Repositories
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Technical organization: Core vs. Data

- CLTK Core software
  - Led by programmers
  - Coordinates data processing
  - Downloads and installs data repositories
Technical organization: Core vs. Data

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- Linguistic data repositories
  - Led by language experts
  - Plaintext corpora
  - Trained models (for machine learning)
  - Dictionaries, word lists
  - Tagged texts (for part-of-speech, dependency grammar)
Technical organization: Core vs. Data

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● CLTK Archive and API
  ○ Reading environment, with NLP and research extras
  ○ Totally led by Luke Hollis
Personnel organization: People and Teams

- CLTK organization on GitHub
  - 39 People
  - 18 Groups
    - Languages, plus Core, API, website,
  - Admins (a few, mostly housekeeping)
  - Unaffiliated Contributors
<table>
<thead>
<tr>
<th>Username</th>
<th>Name</th>
<th>Teams</th>
<th>Visibility</th>
<th>Role</th>
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(Really quick) quickstart

- Make virtualenv and download core
  - $ pyvenv venv
  - $ source venv/bin/activate
  - $ pip install cltk

- Download and import corpora
  - $ python
  - >>> from cltk.corpus.utils.importer import CorpusImporter
  - >>> ci = CorpusImporter('greek')
  - >>> ci.list_corpora
  - ['greek_software_tlgu', 'greek_text_perseus', 'phi7', 'tlg', 'greek_proper_names_cltk', 'greek_models_cltk', 'greek_treebank_perseus', 'greek_lexica_perseus', 'greek_training_set_sentence_cltk', 'greek_word2vec_cltk']
  - >>> ci.import_corpus('greek_text_perseus')
Setup for PHI and TLG corpora

- PHI5, PHI7, and TLG_E
  - Not downloaded, but imported from local files
  - >>> ci.import_corpus('tlg', '~/Documents/corpora/TLG_E/')
  - Makes copy of corpus at ~/cltk_data/originals

- Convert TLG from Beta Code into Unicode
  - >>> from cltk.corpus.greek.tlgu import TLGU
  - >>> t = TLGU()
  - >>> t.convert_corpus(corpus='tlg')
  - >>> t.convert_corpus(corpus='phi5')
  - Makes copy of corpus in ~/cltk_data/greek/text/tlg or ~/cltk_data/latin/text/phi5
NLP for all languages

- Concordance
- Information retrieval
  - Plain and regex searching
  - Robust boolean search on the way
- n-gram: 'Ut primum nocte discussa sol'
  - bigrams: ('ut', 'primum'), ('primum', 'nocte'), ('nocte', 'discussa'), ('discussa', 'sol')
  - trigrams: ('ut', 'primum', 'nocte'), ('primum', 'nocte', 'discussa'), ('nocte', 'discussa', 'sol')
  - 5-grams: ('ut', 'primum', 'nocte', 'discussa', 'sol')
- Word frequencies
  - simple count for a word
  - complete reports for a text
- Word tokenization (via NLTK)
NLP for Greek and Latin

- **Text normalization**
  - $j \rightarrow i$, $v \rightarrow u$ (Latin)
  - Beta Code conversion (for legacy Greek texts)
  - TLG and PHI corpus specific (remove formatting)
  - Unicode normalization

- **Sentence tokenizer**
- **Lemmatizer**
- **Stemmer (Latin)**
- **Word tokenizer, for enclitics (Latin)**
- **Stopword filtering**
NLP for Greek and Latin (cont'd.)

- Named Entity Recognition (NER)
- Part-of-speech (POS) tagger
  - From Perseus/Alphaeus treebank
  - Great work remaining to be done, convert their codes to others (Brill, PROIEL, etc)
- Dependency grammar tagger  # In progress!
- Prosody scanner
- Syllabifier (Greek)
- TLG and PHI5 indices
  - File to author, genre to authors, date to authors, gender to authors, etc.
- Word2Vec
Beyond Greek and Latin

- ~60 repos at https://github.com/cltk
- Chinese, Coptic, Pali, Tibetan, Middle English, Telugu, Classical Hindi, Sanskrit, Hebrew, Aramaic
  - 2.5 GB (!) of Chinese Buddhist texts
  - Coptic texts (via Coptic Scriptorium)
  - Pali Tipitaka
  - Tibetan POS tagged texts and a lexicon
  - Parallel corpora – ready for statistical machine translation (hint, hint)
  - Corpus of ~50 million Hebrew words, ~20 million Aramaic (via Sefaria)
  - Entirety of Perseus/Open Philology
Citation

● Developed by many talented contributors!

● BibTex
  ○ @Misc{johnson2014,
    author = {Kyle P. Johnson et al.},
    title = {CLTK: The Classical Language Toolkit},
    howpublished = {\url{https://github.com/cltk/cltk}},
    note = {{DOI} 10.5281/zenodo.<current_release_id>},
    year = {2014--2016},
  }

● Chicago author-date

Note: Current DOI release id available at: https://github.com/cltk/cltk
Resources

- **This and other lectures**
- **Core software:** [https://github.com/cltk/cltk](https://github.com/cltk/cltk)
  - Bug tracking: [https://github.com/cltk/cltk/issues](https://github.com/cltk/cltk/issues)
    - Beginners’ issues labeled easy
- **Project repositories:** [https://github.com/cltk](https://github.com/cltk)
- **Docs:** [http://docs.cltk.org](http://docs.cltk.org)
- **Python + Command line basics**
  - Intro to the command line: [http://blog.teamtreehouse.com/introduction-to-the-mac-os-x-command-line](http://blog.teamtreehouse.com/introduction-to-the-mac-os-x-command-line)
  - Python installation: [https://www.python.org/downloads](https://www.python.org/downloads) (choose 3.5)
  - Good self-paced Python lessons: [http://learnpythonthehardway.org](http://learnpythonthehardway.org)
Contribute & contact

- Classical Language Toolkit
  - Home: http://cltk.org
  - Docs: http://docs.cltk.org/en/latest
  - Source: https://github.com/cltk/cltk
  - Corpora: https://github.com/cltk
  - Import module: https://github.com/cltk/cltk/blob/master/cltk/corpus/utils/importer.py

- Contribute
  - Issue tracking: https://github.com/cltk/cltk/issues
  - Other questions: kyle@kyle-p-johnson.com
Sources

- Images

- Git
  - GitPython: https://github.com/gitpython-developers/GitPython
  - https://en.wikipedia.org/wiki/Git_(software)

- Science