This Ain’t Your Father’s Digital Data
Another Perspective on Legal Information
(http://www.ldc.upenn.edu/)

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CALI 99 - June 17-19, 1999 - Eugene, Oregon
Introductory Questions

- What is the structure of the presentation?
  - Background: 10 minutes
  - Building Corpora of Digital Data: 45 minutes

- Who is this guy?
  - And how did he come up with such a wacky topic?

- What is this Linguistic something-or-other?
  - And why should I care?

- What are the Goals?
  - connect LDC and language technology developers to the community of researchers, educators and information managers in Law
  - keep in touch with databases and related efforts in Law
  - open discussions on how LDC data can be useful to this community
  - identify opportunities for collaboration

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• Linguistic Data Consortium
  - A non-profit activity of the University of Pennsylvania,
  - an open consortium of Universities, Government agencies and Companies founded in 1992 with DARPA/NSF support
  - to collect, create, prepare and distribute language data
  - for education, research, clinical practice and technology development related to language

• What is language data?
  - Text, image, audio and video containing language.
  - Overlaps with many professions including:
    » medicine: Disarthric Speech
    » government: Resource Management
    » communications: Topic Detection & Tracking
    » law: Juris, Hansard, United Nations Parallel Texts

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Corpora in Law

- Hansard
  - proceedings of Canadian parliament in French and English
  - mid 1970's to 1988
  - 3300 files (645MBs compressed)

- JURIS
  - from Department of Justice Information Retrieval System, all data undisputably in the public domain
  - Administrative Law, Briefs, Case Law, Executive Orders, Federal Regulations, International Agreements, Regulations, Statutory Law, Tax Law from 1700 to 1990
  - 650,000 documents in 1650 files (960MBs compressed)

- UN Parallel Text
  - from UN electronic text archives in English, French, Spanish
  - 1988-1993
  - 92,000 files, 2.5GBs text
LETTER DATED 24 DECEMBER 1992 FROM THE PERMANENT REPRESENTATIVE OF IRAQ TO THE UNITED NATIONS ADDRESSED TO THE SECRETARY-GENERAL

93_00004.ENG: On instructions from my Government, I wish to inform you of fresh Iranian violations of the cease-fire between the two countries during the period from 17 November to 20 December 1992.


93_00004.SPA: Cumpliendo instrucciones de mi Gobierno, deseo informarle de las nuevas violaciones de la cesación del fuego entre ambos países cometidas por el Irán entre el 17 de noviembre y el 20 de diciembre de 1992.
Model

- Originally, distribute data created by researchers
- Increasingly, create databases in response to community needs
- Reach out to new communities
- Make data available to all
  - Members join yearly and receive all corpora published in that year for free.
  - Some corpora can also be sold to non-members.
- Act as mediator of intellectual property creating usage agreements that satisfy data owners and speed acquisition of data
Why?

- Research and development often require huge amounts of data
  - thousands of hours of speech
  - tens of millions of words of text
- Corpus building on a large scale requires:
  - specialized equipment
  - specially trained staff
- Effort required to establish ad hoc collection
  - beyond reach of most non-profits
  - typically not cost-effective for corporations
  - unpalatable to government agencies who want to see public monies used efficiently
- Stable sources of reference data promote discussion, comparison & evaluation
Specialized Equipment

• Infrastructure
  – 3 Sun E4000 multi-processors, >1GB RAM each
  – 1.2TB RAID disk shared
  – 1 TB near-line storage
  – 3.5TB tape robot for backup
  – Administrative Server: NT, 27GB RAID, tape robot

• Special
  – Dedicated fiber-optic network
  – Satellite Downlink - multifunction, receives VOA
  – Telephone Collection - T1, 24 lines, 54GB RAID
  – Annotation Workstations
    » > 60 Sparcs, >20 PCs (few Macs for compatibility)
  – Miscellaneous Collection Hardware
    » AV receivers & recorders, CC decoders, DATs, etc.
Specially Trained Staff

- Director
  - Executive Director
    - Business Admin
    - Admin Assistant
      - Member Relations
        - Assistant
      - Provider Relations
        - Publications
          - Publ Assistant
          - Data Collection
            - AV Tech
            - AV Tech
      - Data Preparation
        - Lead Annotator Coordinator
          - Annotator
          - Annotator
          - Annotator
          - Annotator
          - Annotator
      - Lead Programmer
        - Programmer
        - Programmer
        - Programmer
        - System Admin
        - Project Manager
      - Researcher
        - Researcher
        - Researcher
        - Researcher
        - Research Assistant

- C/C++, Perl, Java
  - but also
  - SGML, XML, SQL
  - ANPA, CC encoding, Unicode, SPHERE, UTF
  - PerlTK, Perldbi, Emacs-Lisp

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How Much Data?

Data Growth

514 CDs

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Summary

• LDC Experience
  – over 150 corpora published
  – over 650 organizations served
    » Engineering, Language, Regional Studies, Medicine and Law
  – nearly 10,000 distributions transacted

• Is it time yet?
  – National Gallery of the Spoken Word - project proposed by the Vincent Voice Library and backed by NSF
  – SignComp - first ever digital repository of and collection facility for video data in support of gestural and sign language research

• Let’s Talk
Why Digital?

- Offer another mode of presentation to accommodate new learning/working styles
- Can be dynamic; data and code can interact
- Accessible faster & more easily even from a distance
  - faculty & staff at conferences, distance learning
- More easily searchable
- Redundant - multiple simultaneous users
- Use can be more easily monitored, profiled
- Deflects demand from non-digital resources
- And otherwise aids in preservation
- In CALI, it offers an alternative to embedding data into code.
Uses in Law

- Structured demographic data for Admissions, Placement; patron & collection data for Library
- Full Text for Legal Research
- Virtual Video Tour
- Talking Resumes
- Video examples of interviews, negotiations
- Data to go!
  - Faculty summer vacations
- Analysis of performance at Moot Court competition
- Woodhouse’s Virtual Supreme Court and Family Law Class
Applications

- Speech Recognition systems to recognize legal terms and adjust to legal language
  - phoneme models and language models
  - commercial approaches (cf Gregory Clinton’s paper)
  - unsupervised approaches

- Speech Synthesis systems to provide improved access to visually challenged

- Machine Translation of foreign government documents
  - new initiatives underway to revive machine translation

- Message Understanding
  - extracts structured data from prose (www.nist.gov)
Preservation

Degradation Curve

Original Condition

Digital Curve

Analog Curve

Degraded Beyond Use

Condition

Time
Types

- Digital Data was traditionally structured data.
- Law has focussed on full text.
- Imaging is certainly coming into its own.
  - multiple Digital Library projects
  - current storage reaching necessary levels
    » 160,000 pages on my laptop
- Technology for audio is prime.
- Video will follow shortly
Creating Digital Data

- Planning
- Acquisition of Originals
- Assessment
- Collection
- Segmentation
- Annotation (adding meta-data)
- Quality Assurance
- Preparation for Distribution
- Distribution
Planning

• What is the purpose of the project?
• How will the data be distributed?
  - Conflicts develop here because network bandwidth can lag behind local bandwidth.
• Originals
  - Nature of content
  - Physical Medium
  - dimensions, physical attributes, robustness, quality, prospects for “cleaning”
• Cost Options & Staff Requirements
  - for internal or outsourced projects
• Process & Timelines
  - which tasks can be parallel which must be serial
Sources
- Not just paper!
- Other databases on the WWW, typesetters files, broadcast, interviews

Resolution - degree to which an analog signal is sampled to produce a digital artefact
- 2-600 dpi graphics, 11, 16, 22, 44KHz audio, 30-60fps video

Quantization - range of values any single sample can have
- 2 byte text, bitonal, gray-scale or color graphics at various depths, 16 bit audio

This area developing rapidly. If much time passes between initial planning and kick-off, another planning cycle is necessary.
<table>
<thead>
<tr>
<th>Limits of Biological System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Information Capture</td>
</tr>
<tr>
<td>Limits of Biological System</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Full Information Capture</td>
</tr>
<tr>
<td>Current Needs</td>
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</tbody>
</table>
Collection Model

Options for Setting Quality

- Limits of Biological System
- Full Information Capture
- Maximum Technology Allows
- Current Needs

Time

Quality

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Collection Model

Options for Setting Quality

- Limits of Biological System
- Full Information Capture
- Maximum Technology Allows
- Maximum Funding Allows
- Current Needs
- Happiness

Time
Segmentation

- Actually or virtually dividing a data glob into component parts.
  - Records and fields in a structured database
  - Chapters and sections of a book
  - Speaker turns, stories or sections in an audio or video collection.

- Granularity will depend upon intended use.
- And will change over time
- Stand-off approach is more suitable to change than actually chopping files

<table>
<thead>
<tr>
<th>Original Audio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attorney</td>
</tr>
<tr>
<td>Client</td>
</tr>
<tr>
<td>Good</td>
</tr>
<tr>
<td>Bad</td>
</tr>
</tbody>
</table>
Annotation

- Any process that adds value to raw data.
- Date & authority fields on structured data
- Categorization of texts (i.e. Cataloguing)
- Identification of sections of text
- Adding/identifying meta-data
- Transcribing speech
- Identifying participants
- Highlighting important points
Quality Assurance

- Terms with an example from Cataloguing
- Precision
  - attempt to find incorrect assignments of an annotation
  - 100%
- Recall
  - attempt to find failed assignments of an annotation
  - 10-20%
- Discrepancy
  - resolve disagreements among annotators
  - 100%
- Measures of Inter-annotator Agreement
  - measure and analyze sources of disagreement
  - 5-10%
Distribution Issues

- Proactive or Reactive digitization
  - either needs a reactive component
- Intellectual property/confidentiality issues
  - What limits do they impose?
- WWW based distribution and bandwidth
- Will data be available in another medium
- Preprocess multiple formats or create on the fly?
- LDC Online Model
  - searching by topic in the Topic Detection and Tracking case
  - other examples: www.ldc.upenn.edu, Select LDC Online
Conclusions

- Digital data is more than just text and images.

- Corpora in Law support not only research and education in Law but also technology development and evaluation for the legal market.

- Standards and Infrastructure are ripe to support digital data in all media - expensively still in video.

- There is still some need for end-user authoring tools.