Extracting Data from PDFs with Python

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data bytes

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A brief history of PDFs 

- **P**ortable **D**ocument **F**ormat - released by Adobe in 1993
- Developed with the idea that every document should be readable and **printable** on **any device** while preserving the fidelity of the content

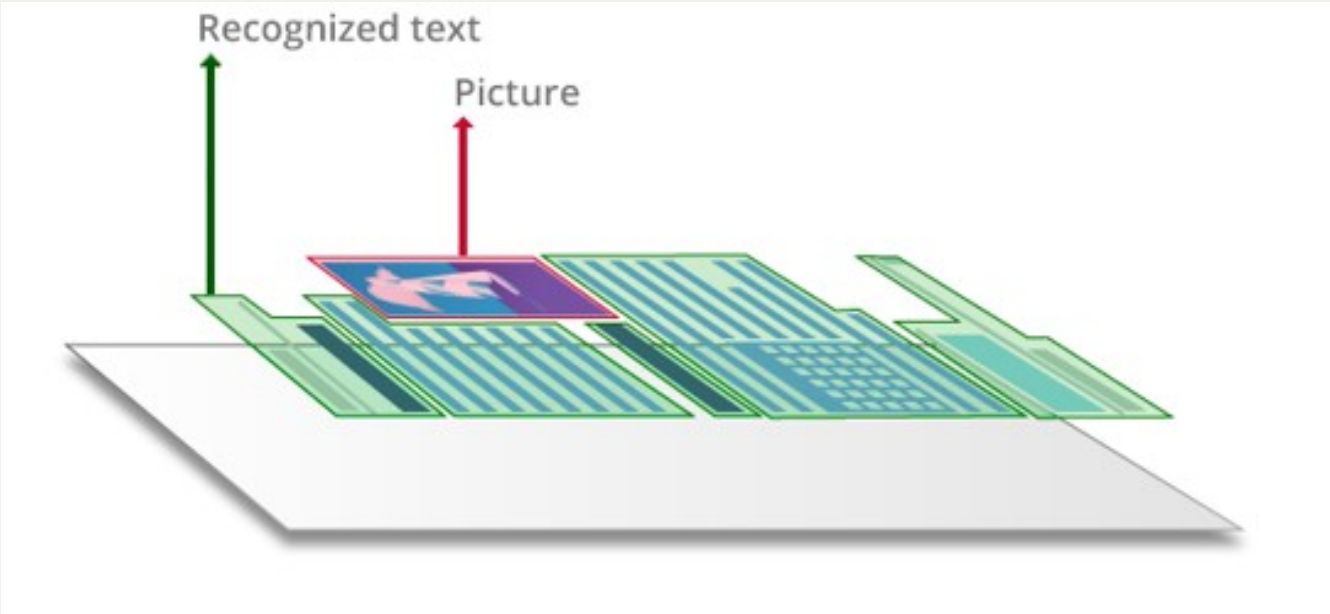
A brief history of PDFs 

- Grew in popularity from the 1990s to 2000s, became an **open format** in 2008
- Multiple standards have developed under the PDF format, and not all PDFs are alike when it comes to working with them

3 types of PDFs

“True” or digitally created PDFs

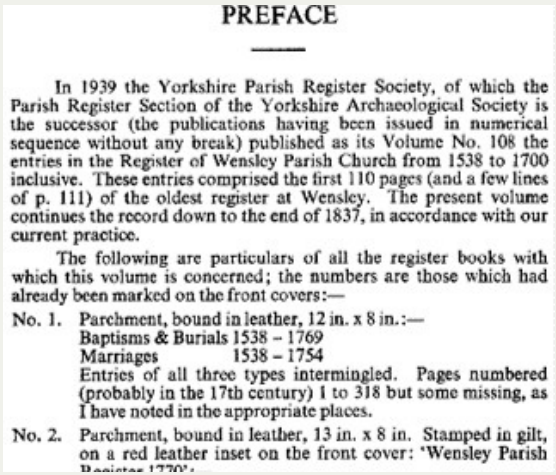
These are PDFs created digitally using software such as Microsoft Word. They consist of searchable text and images.



3 types of PDFs

“Image-only” or scanned PDFs

These are PDFs that are created by scanning or photographing hard copy documents. They contain only the scanned/photographed images of pages and are not automatically searchable.



PREFACE

In 1939 the Yorkshire Parish Register Society, of which the Parish Register Section of the Yorkshire Archaeological Society is the successor (the publications having been issued in numerical sequence without any break) published as its Volume No. 108 the entries in the Register of Wensley Parish Church from 1538 to 1700 inclusive. These entries comprised the first 110 pages (and a few lines of p. 111) of the oldest register at Wensley. The present volume continues the record down to the end of 1837, in accordance with our current practice.

The following are particulars of all the register books with which this volume is concerned; the numbers are those which had already been marked on the front covers:—

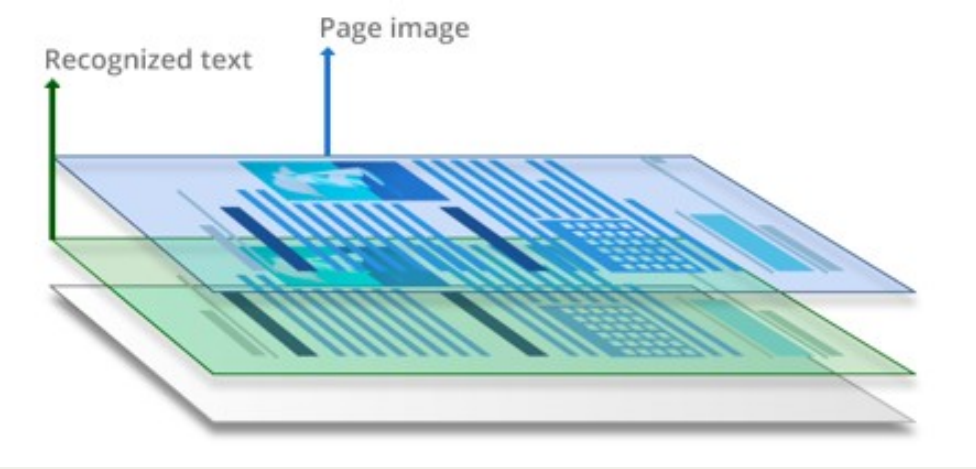
No. 1. Parchment, bound in leather, 12 in. x 8 in.:—
Baptisms & Burials 1538 – 1769
Marriages 1538 – 1754
Entries of all three types intermingled. Pages numbered (probably in the 17th century) 1 to 318 but some missing, as I have noted in the appropriate places.

No. 2. Parchment, bound in leather, 13 in. x 8 in. Stamped in gilt, on a red leather inset on the front cover: 'Wensley Parish

3 types of PDFs

Searchable or OCRed PDFs

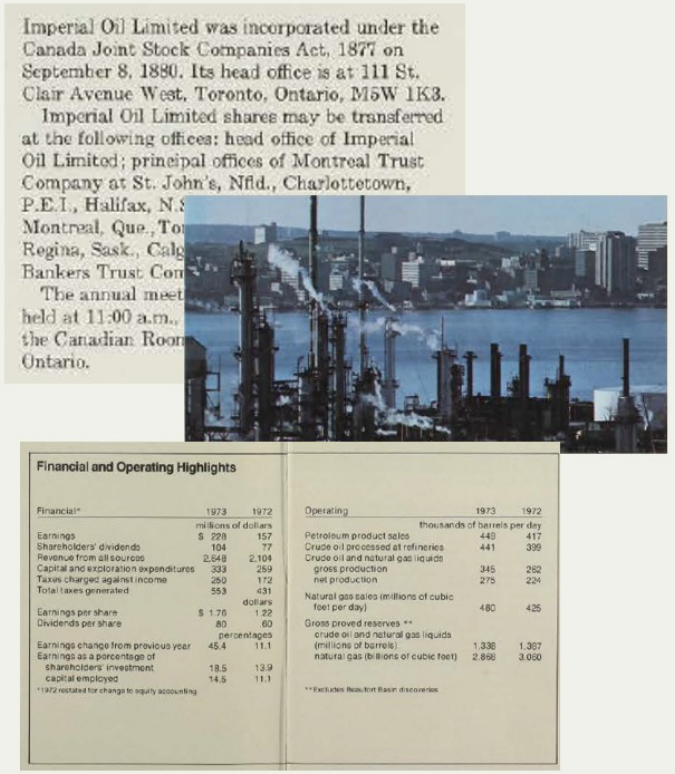
These are the result of applying Optical Character Recognition (OCR) to image-only PDFs. The resulting PDF has two layers – one with the page image, and the other containing the recognized text.



PDFs as data

What can be extracted from PDFs?

- Text
- Images
- Structured data (tables)



Imperial Oil Limited was incorporated under the Canada Joint Stock Companies Act, 1877 on September 8, 1880. Its head office is at 111 St. Clair Avenue West, Toronto, Ontario, M5W 1K3.

Imperial Oil Limited shares may be transferred at the following offices: head office of Imperial Oil Limited; principal offices of Montreal Trust Company at St. John's, Nfld., Charlottetown, P.E.I., Halifax, N.S

Montreal, Que., To

Regina, Sask., Calg

Bankers Trust Com

The annual meet

held at 11:00 a.m.,

the Canadian Room

Ontario.

Financial and Operating Highlights

Financial*	1973	1972
	millions of dollars	
Earnings	$ 228	157
Shareholders' dividends	104	77
Revenue from all sources	2,648	2,104
Capital and exploration expenditures	333	259
Taxes charged against income	260	172
Total taxes generated	553	431
	dollars	
Earnings per share	$ 1.76	1.22
Dividends per share	.80	.60
	percentages	
Earnings change from previous year	45.4	11.1
Earnings as a percentage of shareholders' investment	18.5	13.9
capital employed	14.5	11.1

*1972 restated for change to equity accounting

Operating	1973	1972
	thousands of barrels per day	
Petroleum product sales	449	417
Crude oil processed at refineries	441	399
Crude oil and natural gas liquids		
gross production	345	282
net production	275	224
Natural gas sales (millions of cubic feet per day)	480	425
Gross proved reserves **		
crude oil and natural gas liquids (millions of barrels)	1,338	1,367
natural gas (billions of cubic feet)	2,868	3,060

**Excludes Beaufort Basin discoveries

A word on libraries 

There are several libraries for working with PDFs in Python that do many of the same things. During this training we'll be comparing their performance for different tasks:

- `pdfplumber`
- `pyPDF`
- `PyMuPDF`

PDFs as data 📊

- To Python, every PDF is made up of two components: the document metadata and a set of pages.
- Each page consists of objects that can be classified as:
  - characters
  - lines
  - rectangles
  - curves
  - images
  - and metadata about each of these objects

Extracting text from PDFs 

Goal: Extract the text from the 1973 Imperial Oil Report

Some questions:

- Will the text be extracted left to right across the page, or by column?
- How can we combine the text from all of the pages?

Code for extracting text

```
# Extracting text with pdfplumber
with pdfplumber.open("../Data/Imperial Oil Annual Report 1973.pdf") as pdfp
  print(pdfplumber_1973.pages[1].extract_text())

# Extracting text with pymupdf
import pymupdf
pymupdf_1973 = pymupdf.open("../Data/Imperial Oil Annual Report 1973.pdf")
print(pymupdf_1973[1].get_text())

# Extracting text with pypdf
from pypdf import PdfReader
pypdf_1973 = PdfReader("../Data/Imperial Oil Annual Report 1973.pdf")
document_text = ''
# loop over the pages
for page in pypdf_1973.pages:
  # remove newlines from extracting text
  page_text = page.extract_text().replace("\n", "")
  document_text += page_text
```

Extracting text from PDFs - summary

- Libraries for text extraction:
  - `pdfplumber` - has nice filtering features and great documentation, but processes text line-by-line so not great for multi-column spreads.
  - `pyPDF` - great library for high-quality basic text extraction.
  - `pyMuPDF` - similar to pyPDF with varying accuracy, so good to check both.

Extracting text from PDFs - tips 👉

- Check your results! Compare ouputs across libraries.
- Make sure your output reflects the layout of the text, and doesn't just scan left to right.
- PDFs often contain hidden newlines to preserve the layout of the text, so keep an eye out for strange line breaks and remove `\n` characters if necessary.
- Loop over pages to combine document text.

Extracting images from PDFs 

- Because our old document was OCRed, we were able to extract at least some text from it
- However, OCR doesn't extract images - if you remember, for OCRed documents, the entire page actually has two layers, the page image and the OCRed text - so if we tried to extract images, we'd just get the full page images.
- For image detection, we're limited to working with digital PDFs - such as the 2023 Imperial Oil Annual Report

Code for extracting images

```
# read in the document with pypdf
pypdf_2023 = PdfReader("../../Data/Imperial Oil Annual Report 2023.pdf")

for page in pypdf_2023.pages:
  # loop over the images
  for count, image_file_object in enumerate(page.images):
    # write each image to a .jpg file
    with open(str(count) + image_file_object.name, "wb") as fp:
      fp.write(image_file_object.data)
```

Extracting tables from PDFs 

Some of these libraries can actually detect and extract tables from PDFs! This feature also performs best on digital PDFs, and doesn't always detect things that we as humans know to be tables.

The best implementaton by far is in `PyMuPDF` - let's give it a try on a Baltimore Police Department Weekly Incident Report from Open Baltimore.

Code for extracting tables

```
police_report = pymupdf.open("../Data/police_report_week12.pdf")
page = police_report[0]
tabs = page.find_tables()
df = tabs[0].to_pandas()

page_text = page.get_text()

table_dates = page_text[page_text.find("YEAR TO DATE")+len("YEAR TO DATE"):

header_list = ["Crime type", table_dates[0] + "-" + table_dates[1],
table_dates[2] + "-" + table_dates[3],
"7-day percent change", table_dates[4] + "-" + table_dates[5],
table_dates[6] + "-" + table_dates[7], "28-day percent change",
table_dates[8] + "-" + table_dates[9], table_dates[10] + "-" + table_dates[
"YTD percent change"]

df.columns = header_list
```

Extracting tables - tips 👉

- Check your results, including whether the header is captured
- Don’t forget about text extraction!

Summary

- `pypdf` :
  - best OCR interpreter for extracting text from older documents
  - best for extracting images
- `pymupdf` :
  - best for tables
- `pdfplumber` :
  - good package for beginners

Docs and resources

- pyPDF documentation
- PyMuPDF documentation
- pdfplumber documentation
- Extracting Tables with PyMuPDF

Thanks!

Please give us your feedback on this session at bit.ly/survey-data-bytes and join us at the next Data Bytes!

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