Codebook for Web-scraping of State Legislative Info

Contents

Web scraping is an interactive process between computers and websites using HyperText Markup Language (HTML). Through HTML, web scraping can use bots to extract content and data from websites. Several softwares, like Python, R, and STATA can be used to do web scraping. Here legislative information web scraping is achieved by Python.

In this codebook, special Python language terms like Python module, library, function,and syntax are all italic and texts in the box represent code. Full codes without interpretation are in the appendix.

Codebook for State-Level Policies Affecting Agricultural Costs and Revenues in the U.S.: a

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comprehensive database (1975-2021), patterns, and analysis of policy correlates

```
![](pics/booklogo.png)
```

```
zsh:1: unknown file attribute: i
```

Chapter 1 Introduction

We assemble and make public a novel database of all state-level legislation affecting the costs and revenues associated with agriculture in the United States for the period 1975 to 2021, no matter whether the objectives of those policies were directly related to agriculture or not. Using a combination of web-scraping, machine-learning methods, and artificial intelligence, we (i) analyze all state-level legislation the study 1975-2021 to identify any policies that are likely to affect agricultural costs and revenues, either directly or indirectly, (ii) develop a mechanism to classify whether and how each policy increases or decreases those same agricultural costs and revenues for specific commodities and crops within each state, and (iii) create a web-based tool to allow other researchers to search and browse collected policies by commodity or crop. We will use these data to answer three specific research questions. First, what are the broad patterns over time when it comes to agricultural policy in the U.S. Second, what are the geographical patterns? Third, we will analyze the correlates of agricultural policy within each state for the study period. Finally, we will write a codebook to allow researchers interested in using these data for their own research purposes, and we will make the codebook, data, and web-based tool publicly available through the websites of our respective institutions.

Chapter 2 Web-scraping tool setup

In this chapter, we introduce the webscraping tool set.

Python Language

Python is a programming language that lets you work more quickly and integrate your systems more effectively (https://www.python.org/).

IDEs

An IDE (Integrated Development Environment) understand your code much better than a text editor. It usually provides features such as build automation, code linting, testing and debugging. This can significantly speed up your work. The downside is that IDEs can be complicated to use. There are several IDEs that users can consider. Here we recommend PyCharm or Visual Studio Code. You can download them from JetBrains' website https://www.jetbrains.com/pycharm/ or Visual Studio Code' websites https://code.visualstudio.com/.

Libraries

A Python library, like packages in R, is a reusable chunk of code to save time. Several useful libraries are needed to install for Python to run this script.

Selenium is a powerful web scraping tool by automating browsers to load the target website, retrieve the required data, and take screenshots or assert that certain actions happen on the website. This script relies heavily on Selenium. In addition to Selenium, we also need to import other necessary packages such as pandas,time, os, PyPDF2, glob, pick

```
# import libraries
from selenium import webdriver
from selenium.webdriver.common.by import By
from selenium.webdriver.support.ui import WebDriverWait
from selenium.webdriver.support import expected_conditions as EC
from selenium.webdriver.support.ui import Select
import time
from time import sleep
import pandas as pd
import datefinder
import calendar
import os
import unittest
from random import randint
import PyPDF2
import glob
import pickle
import numpy as np
import fitz
```

Our goal is to webscrape all session laws during 1975-2022 from state-level legislature websites. The General and Special Laws of Texas, often referred to as the “session laws,” constitute a complete set of all bills passed into law by each session of the state legislature.Session laws are organized into chapters, with each chapter consisting of a single “Act,” or bill. As bills are passed into law during a legislative session, the Secretary of State assigns each Act a corresponding chapter number.

Name	FIPS State Numeric Code	Official USPS Code	Website Address
Alabama	1	AL	https://arc-sos.state.al.us/CGI/actyear.mbr/input
Alaska	2	AK	http://www.akleg.gov/basis/Home/BillsandLaws
Arizona	4	AZ	https://apps.azleg.gov/BillStatus/BillOverview?Sessionid=123
Arkansas	5	AR	https://www.arkleg.state.ar.us/Acts/
California	6	CA	https://leginfo.legislature.ca.gov/faces/home.xhtml

Name	FIPS State Numeric Code	Official USPS Code	Website Address
Colorado	8	CO	https://leg.colorado.gov/bills
Connecticut	9	CT	https://www.cga.ct.gov/asp/menu/legdownload.asp
Delaware	10	DE	https://legis.delaware.gov/AllLegislation
District of Columbia	11	DC	https://lims.dccouncil.us/searchresult/
Florida	12	FL	http://www.leg.state.fl.us/Welcome/index.cfm
Georgia	13	GA	https://www.legis.ga.gov/legislation/all
Hawaii	15	HI	https://www.capitol.hawaii.gov/
Idaho	16	ID	https://legislature.idaho.gov/statutesrules/sessionlaws/
Illinois	17	IL	https://www.ilga.gov/previousga.asp
Indiana	18	IN	http://iga.in.gov/results/#
Iowa	19	IA	https://www.legis.iowa.gov/legislation/billTracking
Kansas	20	KS	http://www.kslegislature.org/li/historical/
Kentucky	21	KY	https://legislature.ky.gov/Law/Pages/KyActs.aspx
Louisiana	22	LA	https://www.legis.la.gov/Legis/SessionInfo/SessionInfo.aspx
Maine	23	ME	https://legislature.maine.gov/ros/LOM/LOMpdfDirectory.htm
Maryland	24	MD	http://mgaleg.maryland.gov/mgawebsite/Search/FullText
Massachusetts	25	MA	https://malegislature.gov/Laws/SessionLaws
Michigan	26	MI	https://www.legislature.mi.gov/

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Name	FIPS State Numeric Code	Official USPS Code	Website Address
Minnesota	27	MN	https://www.revisor.mn.gov/search/?search=stat
Mississippi	28	MS	http://billstatus.ls.state.ms.us/sessions.htm
Missouri	29	MO	https://house.mo.gov/LegislationSP.aspx?focusedID=Bill List
Montana	30	MT	http://laws.leg.mt.gov/legprd/law0203w$.startup?P_SESS=19991
Nebraska	31	NE	https://nebraskalegislature.gov/laws/laws.php
Nevada	32	NV	https://www.leg.state.nv.us/Site/Search/search.cfm
New Hampshire	33	NH	http://www.gencourt.state.nh.us/bill_status/legacy/bs2016/
New Jersey	34	NJ	https://www.njleg.state.nj.us/bills/Bills_ADVS.aspx#
New Mexico	35	NM	https://www.nmlegis.gov/Search
New York	36	NY	https://nyassembly.gov/leg/?sh=advanced
North Carolina	37	NC	https://www.ncleg.gov/Search/BillText/
North Dakota	38	ND	https://www.legis.nd.gov/search
Ohio	39	OH	https://www.legislature.ohio.gov/legislation/search/
Oklahoma	40	OK	http://www.oklegislature.gov/AdvancedSearchForm.aspx
Oregon	41	OR	https://www.oregonlegislature.gov/bills_laws/Pages/Oregon-Laws.aspx
Pennsylvania	42	PA	https://www.legis.state.pa.us/cfdocs/legis/home/bills/
Rhode Island	44	RI	http://webserver.rilegislature.gov/search/

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Name	FIPS State Numeric Code	Official USPS Code	Website Address
South Carolina	45	SC	https://www.scstatehouse.gov/query.php
South Dakota	46	SD	https://sdlegislature.gov/Statutes/Archived
Tennessee	47	TN	https://www.capitol.tn.gov/legislation/archives.html
Texas	48	TX	https://lrl.texas.gov/legis/billsearch/lrlhome.cfm
Utah	49	UT	https://le.utah.gov/asp/passedbills/passedbills.asp
Vermont	50	VT	https://legislature.vermont.gov/bill/search/2022
Virginia	51	VA	https://lis.virginia.gov/cgi-bin/legp604.exe?941+men+BIL
Washington	53	WA	http://search.leg.wa.gov/search.aspx#document
West Virginia	54	WV	https://www.wvlegislature.gov/Bill_Status/bill_status.cfm
Wisconsin	55	WI	https://docs.legis.wisconsin.gov/search
Wyoming	56	WY	https://www.wyoleg.gov/Legislation/archives

Since each state-level legislature website has different website structure, we adopted three different webscraping strategies: (i) direct

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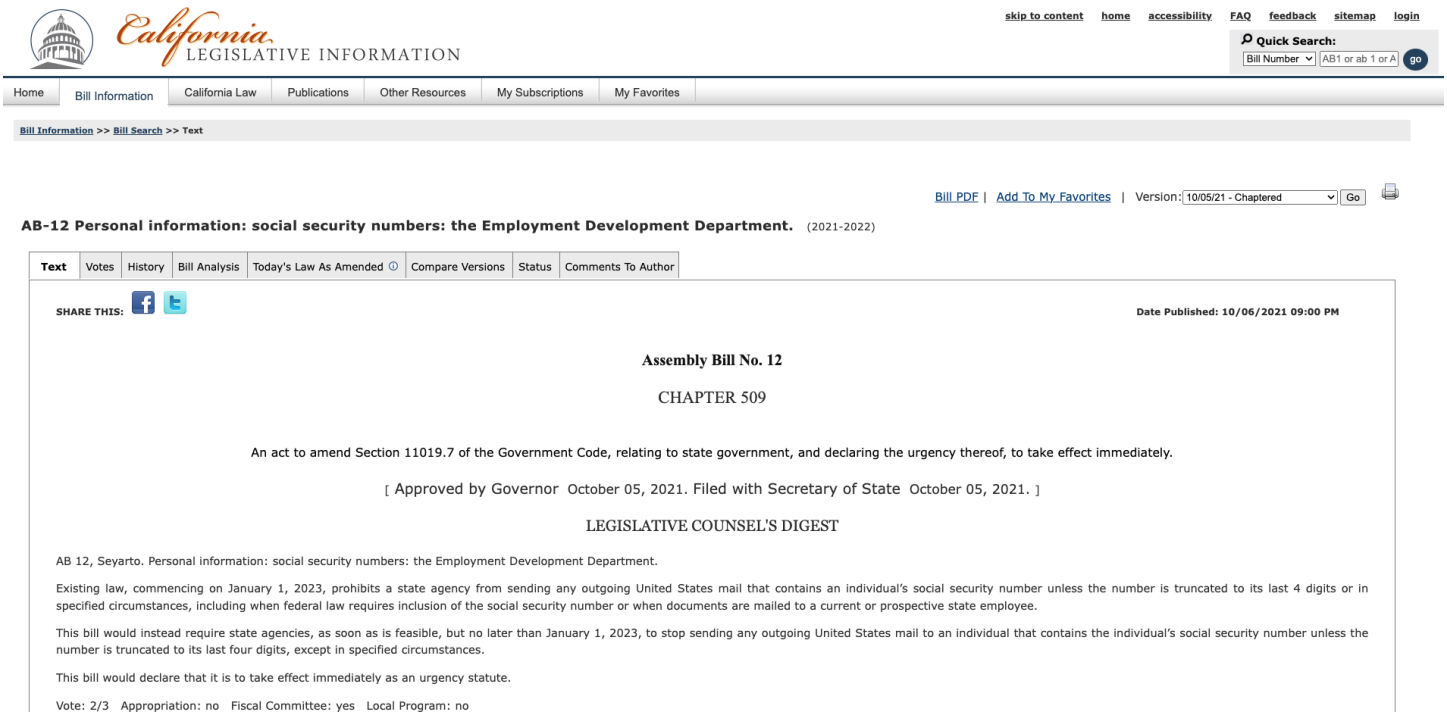
Name	FIPS State Numeric Code	Official USPS Code	Website Address
(ii) downloading act PDF files and extraction, and (iii) mixing them.			

Direct Webscraping

Some legislature websites store acts on their websites as html files or PDF files. So, we can webscrape acts' full texts directly.



Chapter 3 Data cleaning

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Chapter 4 Topic Classification

Chapter 4.1 Keywords Generation

```
###############################################################################
##############################   select gtm_py11 env   ########################
###############################################################################
#import libraries
# Check the Python version
import sys

sys.version
import os
import pandas as pd

working_directory = '../Guided-Topic-Modeling'
working_directory = '/Users/long/Library/CloudStorage/OneDrive-Personal/Projects/Gu
print(os.path.abspath(working_directory))
sys.path.append(working_directory)
print(sys.path)
import glob
from bertopic import BERTopic
#from sklearn.datasets import fetch_20newsgroups
import gensim
import gensim.corpora as corpora
import pickle
import matplotlib.pyplot as plt
import nltk
from nltk import bigrams
from nltk.tokenize import word_tokenize
import re
import openpyxl
import numpy as np

nltk.download('punkt')

# set up working directory
# Change the working directory
os.chdir(working_directory)
# Get the current working directory
cwd = os.getcwd()
# Print the current working directory
print("Current working directory: {0}".format(cwd))

sys.argv = [
    'gtm.py'
```

```
    '--ps2', 'farm',
    '--pw1', '1.0',
    '--pw2', '0.00000000000000000000000001',
    '--size', '1000',
    '--gravity', '0.1'
    # Add '--ns1', '--ns2', '--nw1', '--nw2' and their values if needed
]

exec(open("gtm.py").read())

sys.argv = [
    'gtm.py',
    '--ps1', 'agriculture',
    '--ps2', 'farm',
    '--pw1', '1.0',
    '--pw2', '0.00000000000000000000000001',
    '--size', '2000',
    '--gravity', '0.1'
    # Add '--ns1', '--ns2', '--nw1', '--nw2' and their values if needed
]

exec(open("gtm.py").read())

# Extracting values from sys.argv
ps1_index = sys.argv.index('--ps1') + 1
size_index = sys.argv.index('--size') + 1
gravity_index = sys.argv.index('--gravity') + 1

ps1_value = sys.argv[ps1_index]
size_value = sys.argv[size_index]
gravity_value = sys.argv[gravity_index]

# Specify the folder path
folder_path = 'output'  # Replace with the actual folder path
print(os.path.abspath(folder_path))

# Find the last CSV file
csv_files = glob.glob(os.path.join(folder_path, '*.csv'))
latest_csv_file = max(csv_files, key=os.path.getmtime)

# Construct new file name
new_file_name = f"{ps1_value}_{size_value}_{gravity_value}.csv"
new_file_path = os.path.join(folder_path, new_file_name)

# Rename the file
os.rename(latest_csv_file, new_file_path)
print(f"File '{latest_csv_file}' has been renamed to '{new_file_path}'")

# Read the CSV file (if needed)
topics_dict = pd.read_csv(new_file_path)
topics_dict.rename(columns={'Unnamed: 0': 'keyword'}, inplace=True)

folder_path_sad = '/Volumes/SSD/AFRI/Data/Machine Learning/gtm'
```

```
# Read the CSV file (if needed)
topics_dict.to_csv(new_file_path_ssd)
print(f"File '{latest_csv_file}' has been renamed to '{new_file_path_ssd}'")
```

```
/Users/long/Library/CloudStorage/OneDrive-Personal/Projects/Guided-Topic-Modeling
['/Users/long/miniforge3/envs/gtm_py11/lib/python311.zip', '/Users/long/miniforge3/e
```

```
/Users/long/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/tqdm/auto.py:21: T
  from .autonotebook import tqdm as notebook_tqdm
```

```
[nltk_data] Downloading package punkt to /Users/long/nltk_data...
[nltk_data]   Package punkt is already up-to-date!
```

```
Current working directory: /Users/long/Library/CloudStorage/OneDrive-Personal/Proje
```

```
Initialize GTM
```

```
Generate Topic
```

```
coarse_grain                  word #1  ; angle: 0.763
agricultural                  word #2  ; angle: 0.624
oilseeds                      word #3  ; angle: 0.690
oilseed                       word #4  ; angle: 0.596
grains                        word #5  ; angle: 0.624
grain                         word #6  ; angle: 0.582
feed_grain                    word #7  ; angle: 0.622
cotton                        word #8  ; angle: 0.623
feed_grains                   word #9  ; angle: 0.629
cereal                        word #10 ; angle: 0.639
livestock                     word #11 ; angle: 0.660
feedgrain                     word #12 ; angle: 0.664
soybean                       word #13 ; angle: 0.667
sugar                         word #14 ; angle: 0.666
corn                          word #15 ; angle: 0.666
soymeal                       word #16 ; angle: 0.678
wheat                         word #17 ; angle: 0.679
cereals                       word #18 ; angle: 0.686
soy                           word #19 ; angle: 0.689
canadian_canola               word #20 ; angle: 0.686
crop                          word #21 ; angle: 0.689
soyoil                        word #22 ; angle: 0.691
vegetable_oil                 word #23 ; angle: 0.690
refined_sugar                 word #24 ; angle: 0.694
raw_cotton                    word #25 ; angle: 0.707
```

```
argentine_corn                word #26 ; angle: 0.708
cane_sugar                    word #27 ; angle: 0.713
farming                       word #28 ; angle: 0.715
soybeans                      word #29 ; angle: 0.716
soybean_meal                  word #30 ; angle: 0.716
maize                         word #31 ; angle: 0.717
argentine_soy                 word #32 ; angle: 0.733
agribusiness                  word #33 ; angle: 0.739
rapeseed_meal                 word #34 ; angle: 0.740
chickpeas                     word #35 ; angle: 0.741
beet_sugar                    word #36 ; angle: 0.745
canola                        word #37 ; angle: 0.752
durum_wheat                   word #38 ; angle: 0.752
rough_rice                    word #39 ; angle: 0.752
carryover_stocks              word #40 ; angle: 0.752
barley                        word #41 ; angle: 0.754
rapeseed                      word #42 ; angle: 0.753
sugarbeet                     word #43 ; angle: 0.756
```

```
horticultural                 word #44 ; angle: 0.759
agricultural_commodities      word #45 ; angle: 0.764
soybean_export                word #46 ; angle: 0.766
durum                         word #47 ; angle: 0.769
edible_oil                    word #48 ; angle: 0.769
cotton_growers                word #49 ; angle: 0.771
post-harvest                  word #50 ; angle: 0.772
coffee                        word #51 ; angle: 0.772
yellow_corn                   word #52 ; angle: 0.778
agricultural_products         word #53 ; angle: 0.778
bean                          word #54 ; angle: 0.780
rice                          word #55 ; angle: 0.780
sunflowerseed                 word #56 ; angle: 0.782
pigmeat                       word #57 ; angle: 0.784
drought-hit                   word #58 ; angle: 0.793
sorghum                       word #59 ; angle: 0.799
```

```
cottonseed                    word #60 ; angle: 0.799
malting_barley                word #61 ; angle: 0.800
arable                        word #62 ; angle: 0.802
ddgs                          word #63 ; angle: 0.809
```

```
sugarcane                     word #64 ; angle: 0.810
paddy_rice                    word #65 ; angle: 0.812
coarse_grains                 word #66 ; angle: 0.814
new-crop                      word #67 ; angle: 0.814
```

Skip to main content

```
exportable                    word #68 ; angle: 0.816
feed_wheat                    word #69 ; angle: 0.816
citrus                        word #70 ; angle: 0.817
```

```
wheat_crops                   word #71 ; angle: 0.818
soybean_crushing              word #72 ; angle: 0.819
cotton_crop                   word #73 ; angle: 0.825
```

```
wheat-growing                 word #74 ; angle: 0.825
beet                          word #75 ; angle: 0.825
sugarcane_crop                word #76 ; angle: 0.825
```

```
spring_wheat                  word #77 ; angle: 0.827
broiler                       word #78 ; angle: 0.827
```

```
malting                       word #79 ; angle: 0.827
wheat_growers                 word #80 ; angle: 0.828
farmers                       word #81 ; angle: 0.828
millers                       word #82 ; angle: 0.828
```

```
pork                          word #83 ; angle: 0.830
rapeseed_harvest              word #84 ; angle: 0.830
crushers                      word #85 ; angle: 0.830
corn_soybean                  word #86 ; angle: 0.833
crops                         word #87 ; angle: 0.833
```

```
citrus_fruit                  word #88 ; angle: 0.835
```

```
cane-growing                  word #89 ; angle: 0.838
```

```
poultry                       word #90 ; angle: 0.838
old-crop                      word #91 ; angle: 0.838
```

```
erratic_weather               word #92 ; angle: 0.838
wheat_flour                   word #93 ; angle: 0.839
```

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```
flour_millers                  word #94 ; angle: 0.839
agronomic                      word #95 ; angle: 0.840
```

```
seed                           word #96 ; angle: 0.841
```

```
wheat_crop                     word #97 ; angle: 0.842
pre-harvest                    word #98 ; angle: 0.842
```

```
planted_acreage                word #99 ; angle: 0.842
cotton_acreage                 word #100; angle: 0.843
```

```
sugar_beets                    word #101; angle: 0.844
soybean_processors             word #102; angle: 0.844
sugar_cane                     word #103; angle: 0.844
rapeseed_crop                  word #104; angle: 0.845
```

```
meat                           word #105; angle: 0.848
soybean_crop                   word #106; angle: 0.849
```

```
cotton-growing                 word #107; angle: 0.849
pork_producers                 word #108; angle: 0.849
```

```
rapeseed_oil                   word #109; angle: 0.850
corn-growing                   word #110; angle: 0.851
animal_feed                    word #111; angle: 0.851
```

```
soybean_imports                word #112; angle: 0.852
grower                         word #113; angle: 0.852
```

```
sugar_beet                     word #114; angle: 0.852
```

```
grain_crops                    word #115; angle: 0.853
```

Skip to main content

```
sugar-producing                word #116; angle: 0.853
agricultural_goods             word #117; angle: 0.853
granary                        word #118; angle: 0.854
farm_goods                     word #119; angle: 0.854
```

```
sunflower                      word #120; angle: 0.855
forestry                       word #121; angle: 0.855
growers                        word #122; angle: 0.856
soy_crop                       word #123; angle: 0.856
soy_corn                       word #124; angle: 0.856
```

```
feedgrains                     word #125; angle: 0.857
wool                           word #126; angle: 0.857
```

```
soymeal_exports                word #127; angle: 0.859
agronomy                       word #128; angle: 0.860
```

```
fertilizer                     word #129; angle: 0.861
```

```
---------------------------------------------------------------------------
KeyboardInterrupt                         Traceback (most recent call last)
Cell In[1], line 52
     39 print("Current working directory: {0}".format(cwd))
     41 sys.argv = [
     42     'gtm.py',
     43     '--ps1', 'agriculture',
   (...)
     49     # Add '--ns1', '--ns2', '--nw1', '--nw2' and their values if needed
     50 ]
---> 52 exec(open("gtm.py").read())
     54 sys.argv = [
     55     'gtm.py',
     56     '--ps1', 'agriculture',
   (...)
     62     # Add '--ns1', '--ns2', '--nw1', '--nw2' and their values if needed
     63 ]
     65 exec(open("gtm.py").read())

File <string>:307

File <string>:228, in run(self, params, pos_seed, neg_seed)
```

```
    702 elif meth == 'cg':
--> 703     res = _minimize_cg(fun, x0, args, jac, callback, **options)
    704 elif meth == 'bfgs':
    705     res = _minimize_bfgs(fun, x0, args, jac, callback, **options)

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_optimi
   1805     return np.dot(pk, gfk) <= -sigma_3 * np.dot(gfk, gfk)
   1807 try:
   1808     alpha_k, fc, gc, old_fval, old_old_fval, gfkp1 = \
-> 1809             _line_search_wolfe12(f, myfprime, xk, pk, gfk, old_fval,
   1810                                  old_old_fval, c2=0.4, amin=1e-100, amax=1
   1811                                  extra_condition=descent_condition)
   1812 except _LineSearchError:
   1813     # Line search failed to find a better solution.
   1814     warnflag = 2

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_optimi
   1201 """
   1202 Same as line_search_wolfe1, but fall back to line_search_wolfe2 if
   1203 suitable step length is not found, and raise an exception if a
   (...)
   1210
   1211 """
   1213 extra_condition = kwargs.pop('extra_condition', None)
-> 1215 ret = line_search_wolfe1(f, fprime, xk, pk, gfk,
   1216                          old_fval, old_old_fval,
   1217                          **kwargs)
   1219 if ret[0] is not None and extra_condition is not None:
   1220     xp1 = xk + ret[0] * pk

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_linese
     80     return np.dot(gval[0], pk)
     82 derphi0 = np.dot(gfk, pk)
---> 84 stp, fval, old_fval = scalar_search_wolfe1(
     85         phi, derphi, old_fval, old_old_fval, derphi0,
     86         c1=c1, c2=c2, amax=amax, amin=amin, xtol=xtol)
     88 return stp, fc[0], gc[0], fval, old_fval, gval[0]

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_linese
    158 if task[:2] == b'FG':
    159     alpha1 = stp
--> 160     phi1 = phi(stp)
    161     derphi1 = derphi(stp)
    162 else:

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_linese
     73 def phi(s):
     74     fc[0] += 1
---> 75     return f(xk + s*pk, *args)

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_differ
    265 if not np.array_equal(x, self.x):
```

Skip to main content

```
    268 return self.f

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_differ
    249 def _update_fun(self):
    250     if not self.f_updated:
--> 251         self._update_fun_impl()
    252         self.f_updated = True

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_differ
    154 def update_fun():
--> 155     self.f = fun_wrapped(self.x)

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/scipy/optimize/_differ
    133 self.nfev += 1
    134 # Send a copy because the user may overwrite it.
    135 # Overwriting results in undefined behaviour because
    136 # fun(self.x) will change self.x, with the two no longer linked.
--> 137 fx = fun(np.copy(x), *args)
    138 # Make sure the function returns a true scalar
    139 if not np.isscalar(fx):

File <string>:106, in func(self, a, W_orth, I, X, C, weights, params)

File ~/miniforge3/envs/gtm_py11/lib/python3.11/site-packages/numpy/core/fromnumeric
   2102     """
   2103     Clip (limit) the values in an array.
   2104
   (...)
   2167
   2168     """
   2169     return _wrapfunc(a, 'clip', a_min, a_max, out=out, **kwargs)
-> 2172 def _sum_dispatcher(a, axis=None, dtype=None, out=None, keepdims=None,
   2173                     initial=None, where=None):
   2174     return (a, out)
   2177 @array_function_dispatch(_sum_dispatcher)
   2178 def sum(a, axis=None, dtype=None, out=None, keepdims=np._NoValue,
   2179         initial=np._NoValue, where=np._NoValue):

KeyboardInterrupt:
```

4.2 Topic Classification

```
import pandas as pd
import os
import re
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize
import nltk
from nltk.util import bigrams
import codecs
import ast  # Module for literal string evaluation

#from word_forms.word_forms import get_word_forms
from itertools import islice
import numpy as np
import matplotlib.pyplot as plt
import geopandas as gpd

###
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib.ticker import FuncFormatter
import matplotlib.colors as mcolors
import seaborn as sns
import geopandas as gpd
from shapely.geometry import Polygon
import missingno as msno
import os
import wget
import openpyxl
import math
from wordcloud import WordCloud

import pickle
from collections import defaultdict

###

# Set the working directory
os.chdir('/Volumes/SSD/AFRI/Data/')

# Verify the current working directory
print(os.getcwd())


######## functions

def generate_uni_bigrams_individual(text):
```

```
    # Try decoding the text using ISO-8859-1 encoding
    try:
        text = text.decode('ISO-8859-1')
    except AttributeError:
        pass  # Skip if the text is already a string
    except UnicodeDecodeError:
        # If decoding with ISO-8859-1 fails, try UTF-8 with errors='replace'
        text = text.decode('utf-8', errors='replace')

    # Tokenize the text
    tokens = word_tokenize(text)

    # Remove non-alphabetic tokens and lowercase the alphabetic tokens
    unigrams = [word.lower() for word in tokens if word.isalpha()]

    # Generate bigrams from the cleaned tokens
    bigram_tuples = list(bigrams(unigrams))

    # Join the words in each bigram with an underscore
    bigrams_formatted = ['_'.join(bigram) for bigram in bigram_tuples]

    # Combine unigrams and bigrams into one list
    combined_list = unigrams + bigrams_formatted

    return combined_list


def generate_uni_bigrams_folder(source_folder, destination_folder):
    # Create the destination folder if it doesn't exist
    if not os.path.exists(destination_folder):
        os.makedirs(destination_folder)

    # Iterate over each file in the source folder
    for filename in os.listdir(source_folder):
        if filename.endswith(".csv") and not filename.startswith('._'):
            print(filename)
            # Read the CSV file into a DataFrame
            source_filepath = os.path.join(source_folder, filename)
            df = pd.read_csv(source_filepath)

            # Drop the 'Unnamed: 0' column if it exists
            if 'Unnamed: 0' in df.columns:
                df.drop('Unnamed: 0', axis=1, inplace=True)

            # Apply the function generate_uni_bigrams to create 'uni_bigrams' colum
            df['uni_bigrams'] = df['original_text'].apply(generate_uni_bigrams_indi

            # Define the new filename for the destination
            csv_filename = filename.replace("_clean.csv", "_processed.csv")
            destination_filepath_csv = os.path.join(destination_folder, csv_filenam

            json_filename = filename.replace("_clean.csv", "_processed.json")
```

```
            pkl_filename = filename.replace("_clean.csv", "_processed.pkl")
            destination_filepath_pkl = os.path.join(destination_folder, pkl_filenam

            # Save the modified DataFrame to a new CSV file in the destination fold
            df.to_csv(destination_filepath_csv, index=False)
            df.to_json(destination_filepath_json, orient='records')
            df.to_pickle(destination_filepath_pkl)

            print(f"Processed file '{filename}' successfully saved")


def count_total_occurrences(text, keywords):
    # Initialize a dictionary to store word counts
    word_counts = {word: 0 for word in keywords}

    for word in text:
        if word.lower() in word_counts:  # Convert to lowercase for case-insensitiv
            word_counts[word.lower()] += 1

    # Sum all the occurrences
    total_occurrences = sum(word_counts.values())

    return total_occurrences


def count_individual_occurrences(text, keywords):
    # Initialize a dictionary to store counts of keywords, starting at 0
    word_counts = {word: 0 for word in keywords}

    # Count occurrences of each keyword in the text
    for word in text:
        word_lower = word.lower()  # Convert word to lowercase to ensure case-insen
        if word_lower in word_counts:
            word_counts[word_lower] += 1

    # Filter out keywords with zero occurrences
    word_counts = {word: count for word, count in word_counts.items() if count > 0}

    return word_counts


def count_individual_score(text, keyword_weights):
    # Initialize a dictionary to store counts of keywords, starting at 0
    word_counts = {word: 0 for word in keywords}

    # Count occurrences of each keyword in the text
    for word in text:
        word_lower = word.lower()  # Convert word to lowercase to ensure case-insen
        if word_lower in word_counts:
            word_counts[word_lower] += 1

    # Filter out keywords with zero occurrences
```

```
    return word_counts


def calculate_keyword_scores(text, keywords, keyword_weights):
    # Initialize a dictionary to store counts of keywords
    word_counts = {word: 0 for word in keywords}

    # Count occurrences of each keyword in the text
    for word in text:
        word_lower = word.lower()
        if word_lower in word_counts:
            word_counts[word_lower] += 1

    # Calculate scores for each keyword based on its weight and occurrence count
    keyword_scores = {word: count * keyword_weights[word] for word, count in word_c

    # Sort the keywords by their scores in descending order
    sorted_keyword_scores = sorted(keyword_scores.items(), key=lambda item: item[1]

    # Convert the sorted list of tuples back into a dictionary
    sorted_keyword_scores_dict = dict(sorted_keyword_scores)

    return sorted_keyword_scores_dict


def calculate_weighted_score(text, keyword_weights):
    # Initialize the total score
    total_score = 0
    #print(text)
    # Split the text into words
    for word in text:
        # If the word is in the list and has a weight, add its weighted score
        # Check if the word is in the keyword_weights dictionary and add its weight
        if word in keyword_weights:
            total_score += keyword_weights[word]
    return total_score


def extract_top_five_items(dictionary):
    # Convert the string representation of dictionary to a dictionary object
    dictionary = ast.literal_eval(dictionary)
    # Sort the dictionary by values in descending order and take the first five ite
    top_five_items = dict(sorted(dictionary.items(), key=lambda item: item[1], reve
    return top_five_items


def extract_top_five_items(dictionary):
    sorted_items = sorted(dictionary.items(), key=lambda item: item[1], reverse=Tru

    # Convert sorted items back to a dictionary if needed
    top_five_items = dict(sorted_items)
    return top_five_items
```

```
def count_words(text):
    text = str(text)
    words = text.split()
    return len(words)


def classification(source_folder, destination_folder, keywords, keyword_weights):
    # Create the destination folder if it doesn't exist
    if not os.path.exists(destination_folder):
        os.makedirs(destination_folder)

    # Iterate over each file in the source folder
    for filename in os.listdir(source_folder):
        if filename.endswith(".pkl") and not filename.startswith('._'):
            print(filename)
            # Read the CSV file into a DataFrame
            source_filepath = os.path.join(source_folder, filename)

            with open(source_filepath, 'rb') as file:
                df = pickle.load(file)

                # Drop the 'Unnamed: 0' column if it exists
                if 'Unnamed: 0' in df.columns:
                    df.drop('Unnamed: 0', axis=1, inplace=True)

                # Count occurrences of keywords in uni_bigrams
                df['uni_bigrams_occurrences'] = df['uni_bigrams'].apply(lambda x: c

                # Count occurrences of each keyword in the text
                df['uni_bigrams_word_counts'] = df['uni_bigrams'].apply(
                    lambda x: count_individual_occurrences(x, keywords))

                # top 5 keywords with scores
                df['top5_uni_bigrams_word_counts'] = df['uni_bigrams_word_counts'].
                    lambda x: extract_top_five_items(x))

                # Calculate scores of each keyword in the text
                df['uni_bigrams_word_scores'] = df['uni_bigrams'].apply(
                    lambda x: calculate_keyword_scores(x, keywords, keyword_weights

                # Calculate total scores of keywords in the text
                df['total_weighted_score'] = df['uni_bigrams'].apply(
                    lambda x: calculate_weighted_score(x, keyword_weights))

                # Count the words
                df['original_text_word_count'] = df['original_text'].apply(count_wo

                # Calculate total scores of keywords per word in the text
                df['total_weighted_score_per_word'] = df.apply(
                    lambda row: row['total_weighted_score'] / row['original_text_wo

                    axis=1)
```

```
# top 5 keywords with scores
df['top5_uni_bigrams_word_scores'] = df['uni_bigrams_word_scores'].
    lambda x: extract_top_five_items(x))

#.apply(lambda x: extract_top_five_items(x) if isinstance(x, str) e

# Define the new filename for the destination
csv_filename = filename.replace("_processed.pkl", "_classified.csv"
destination_filepath_csv = os.path.join(destination_folder, csv_fil

json_filename = filename.replace("_processed.pkl", "_classified.jso
destination_filepath_json = os.path.join(destination_folder, json_f

pkl_filename = filename.replace("_processed.pkl", "_classified.pkl"
destination_filepath_pkl = os.path.join(destination_folder, pkl_fil

# Save the modified DataFrame to a new CSV file in the destination
#df.to_csv(destination_filepath_csv, index=False)
#df.to_json(destination_filepath_json, orient='records')
df.to_pickle(destination_filepath_pkl)

# This will hold the combined results
combined_dict = defaultdict(int)

# Iterate through each dictionary in the DataFrame's column
for index, row in df.iterrows():
    for key, value in row['uni_bigrams_word_counts'].items():
        combined_dict[key] += value

# Convert the defaultdict back to a regular dictionary for display
result_dict_count = dict(combined_dict)

# Create a WordCloud object
wordcloud = WordCloud(width=800, height=400, background_color='whit

# Generate a word cloud from frequencies
wordcloud.generate_from_frequencies(result_dict_count)

# Display the generated image:
plt.figure(figsize=(10, 5))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis('off')  # Do not show axes to keep it clean

pic_filename = filename.replace("_processed.pkl", "_wordcloud_count
destination_filepath_pic = os.path.join(destination_folder, pic_fil

# Save the figure to a file
plt.savefig(destination_filepath_pic, format='png', bbox_inches='ti

dict_count_filename = filename.replace("_processed.pkl", "_dic_coun
destination_filepath_dict = os.path.join(destination_folder, dict_c

# Convert dictionary to DataFrame
```

```
                # Save to CSV
                result_list_count.to_csv(destination_filepath_dict, index=False)

                # This will hold the combined results
                combined_dict = defaultdict(int)

                # Iterate through each dictionary in the DataFrame's column
                for index, row in df.iterrows():
                    for key, value in row['uni_bigrams_word_scores'].items():
                        combined_dict[key] += value

                # Convert the defaultdict back to a regular dictionary for display
                result_dict_score = dict(combined_dict)

                # Create a WordCloud object
                wordcloud = WordCloud(width=800, height=400, background_color='whit

                # Generate a word cloud from frequencies
                wordcloud.generate_from_frequencies(result_dict_score)

                # Display the generated image:
                plt.figure(figsize=(10, 5))
                plt.imshow(wordcloud, interpolation='bilinear')
                plt.axis('off')  # Do not show axes to keep it clean

                pic_filename = filename.replace("_processed.pkl", "_wordcloud_score
                destination_filepath_pic = os.path.join(destination_folder, pic_fil

                # Save the figure to a file
                plt.savefig(destination_filepath_pic, format='png', bbox_inches='ti

                dict_count_filename = filename.replace("_processed.pkl", "_dic_scor
                destination_filepath_dict = os.path.join(destination_folder, dict_c

                # Convert dictionary to DataFrame
                result_list_score = pd.DataFrame(list(result_dict_score.items()), c

                # Save to CSV
                result_list_score.to_csv(destination_filepath_dict, index=False)

                print(f"Classified file '{filename}' successfully saved")


source_folder = "./Raw_Data/Cleaned"
destination_folder = "./Processed_Data"

generate_uni_bigrams_folder(source_folder, destination_folder)

keywords = pd.read_excel('./Meachine Learning/gtm/agriculture_1000_0.1_human_refine
    'keyword'].values.tolist()
keyword_weights = dict(
```

```
source_folder = "./Processed_Data"
destination_folder = "./Outcomes"

classification(source_folder, destination_folder, keywords, keyword_weights)
########
destination_folder = "./Outcomes"

# Define the columns to keep
columns_to_keep = ['state', 'year', 'act_num', 'uni_bigrams_occurrences', 'uni_bigr
                   'top5_uni_bigrams_word_counts', 'uni_bigrams_word_scores', 'tota
                   'original_text_word_count',
                   'total_weighted_score_per_word', 'top5_uni_bigrams_word_scores']

# Initialize an empty DataFrame to hold all the data
df = pd.DataFrame()

# Loop through each file in the folder
for filename in os.listdir(destination_folder):
    if filename.endswith('count.csv') and not filename.startswith('._'):  # Check i
        print(filename)
        file_path = os.path.join(destination_folder, filename)
        data = pd.read_csv(file_path)
        #with open(file_path, 'rb') as file:
        #data = pickle.load(file)
        #data = data[columns_to_keep]
        # Append the data to the main DataFrame
        df = df._append(data, ignore_index=True)

#df['top5_uni_bigrams_word_scores'] = df['uni_bigrams_word_scores'].apply(lambda d:
df = df.groupby('Word')['Frequency'].sum().reset_index()
df.to_csv('./Outcomes/all_words_count.csv')

# Convert DataFrame to dictionary
word_freq = dict(zip(df['Word'], df['Frequency']))

# Create a WordCloud object
wordcloud = WordCloud(width=800, height=400, background_color='white')

# Generate a word cloud
wordcloud.generate_from_frequencies(word_freq)

# Display the generated image:
plt.figure(figsize=(10, 5))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis('off')  # Do not show axes to keep it clean
plt.show()
plt.savefig('./Outcomes/counts.png', format='png', bbox_inches='tight', dpi=300)

# Initialize an empty DataFrame to hold all the data
df = pd.DataFrame()

# Loop through each file in the folder
for filename in os.listdir(destination_folder):
```

```
        print(filename)
        file_path = os.path.join(destination_folder, filename)
        data = pd.read_csv(file_path)
        #with open(file_path, 'rb') as file:
        #data = pickle.load(file)
        #data = data[columns_to_keep]
        # Append the data to the main DataFrame
        df = df._append(data, ignore_index=True)

#df['top5_uni_bigrams_word_scores'] = df['uni_bigrams_word_scores'].apply(lambda d:
df = df.groupby('Word')['Frequency'].sum().reset_index()
df.to_csv('./Outcomes/all_words_score.csv')

# Convert DataFrame to dictionary
word_freq = dict(zip(df['Word'], df['Frequency']))

# Create a WordCloud object
wordcloud = WordCloud(width=800, height=400, background_color='white')

# Generate a word cloud
wordcloud.generate_from_frequencies(word_freq)

# Display the generated image:
plt.figure(figsize=(10, 5))
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis('off')  # Do not show axes to keep it clean
plt.show()
plt.savefig('./Outcomes/scores.png', format='png', bbox_inches='tight', dpi=300)

df = pd.read_csv('./Outcomes/classification_results.csv')

try:
    df = df.drop(['Unnamed: 0'], axis=1)
except:
    pass

df['year'] = pd.to_numeric(df['year'], errors='coerce')
df.dropna(subset=['year'], inplace=True)

df['year'] = df['year'].astype(str).str[:4].astype(int)

df = df[(df['year'] >= 1975) & (df['year'] <= 2021)]

# Group by 'year' and 'state' and calculate the count of positive scores and the to
grouped_data = df.groupby(['year', 'state']).agg(
    positive_score_count=('total_weighted_score_per_word', lambda x: (x > 0).sum())
    total_score_count=('total_weighted_score_per_word', 'count')
)

# Calculate the proportion of the count of positive scores to the total count of sc
grouped_data['proportion'] = grouped_data['positive_score_count'] / grouped_data['t

# Reset the index to make 'year' and 'state' columns again
```

```
grouped_data.to_csv('./Outcomes/classification_results_short.csv')

# Pivot the data for plotting
pivot_data = grouped_data.pivot(index='year', columns='state', values='proportion')

plt.figure(figsize=(30, 24))  # Increase figure size for better clarity and space
pivot_data.plot(kind='line')

# Increase font sizes for better readability
plt.title('Proportion of Ag Legislation per Year by State', fontsize=12)
plt.xlabel('Year', fontsize=12)
plt.ylabel('Proportion of Ag Legislation', fontsize=12)

# Increase tick label size
plt.xticks(fontsize=12)
plt.yticks(fontsize=12)

# Expand the right margin to ensure the legend and plot do not overlap
plt.subplots_adjust(right=0.65)

# Place the legend to the right of the plot, making it larger to ensure legibility
plt.legend(title='State', loc='center left', bbox_to_anchor=(1.05, 0.5), ncol=2, fo

# Add grid for better readability of the plot
plt.grid(True)

plt.show()

state_data = df.groupby('state').agg(
    ag_count=('total_weighted_score_per_word', lambda x: (x > 0).sum()),
    ag_count_0004=('total_weighted_score_per_word', lambda x: (x > 0.004).sum()),
    total_count=('total_weighted_score_per_word', 'count')
)

state_data['ag_proportion_0000'] = state_data['ag_count'] / state_data['total_count
state_data['ag_proportion_0004'] = state_data['ag_count_0004'] / state_data['total_
state_data.to_csv('./Outcomes/state.csv')

state_data = pd.read_csv('./Outcomes/state.csv')

gdf = gpd.read_file('./Geo/cb_2018_us_state_500k.shp')

fips = pd.read_excel('./Geo/statefp.xlsx')
fips['STATEFP'] = fips['STATEFP'].astype(str).apply(lambda x: x.zfill(2))

gdf = gdf.merge(fips, how='left', on='STATEFP')
gdf = gdf.merge(state_data, how='left', on='state')


# Apply this to the gdf to ensure all states are assigned colors by the same func
def makeColorColumn(gdf, variable, vmin, vmax):
    # apply a function to a column to create a new column of assigned colors f, retu
```

```
    mapper = plt.cm.ScalarMappable(norm=norm, cmap=plt.cm.YlOrBr)
    gdf['value_determined_color'] = gdf[variable].apply(lambda x: mcolors.to_hex(ma
    return gdf


# set the value column that will be visualised
variable = 'ag_proportion_0000'
#variable = 'ag_proportion_0004'

# make a column for value_determined_color in gdf
# set the range for the choropleth values with the upper bound the rounded up maxim

if variable == 'ag_proportion_0000':
    gdf['ag_proportion'] = gdf['ag_proportion_0000']
else:
    gdf['ag_proportion'] = gdf['ag_proportion_0004']

vmin, vmax = gdf.ag_proportion.min(), gdf.ag_proportion.max()

# Choose the continuous colorscale "YlOrBr" from https://matplotlib.org/stable/tuto
colormap = "YlOrBr"
gdf = makeColorColumn(gdf, variable, vmin, vmax)

# create "visframe" as a re-projected gdf using EPSG 2163 for CONUS
#visframe = gdf.to_crs({'init':'epsg:2163'})
visframe = gdf.to_crs({'proj': 'aea', 'lat_1': 29.5, 'lat_2': 45.5, 'lon_0': -96, '

# create figure and axes for Matplotlib
fig, ax = plt.subplots(1, figsize=(20, 20))
# remove the axis box around the vis
ax.axis('off')
# set the font for the visualization to Helvetica
hfont = {'fontname': 'Helvetica'}

# add a title and annotation
ax.set_title('State-Level Agricultural Legislation\n1975-2021', **hfont, fontdict={

# Create colorbar legend
fig = ax.get_figure()
# add colorbar axes to the figure
# This will take some iterating to get it where you want it [l,b,w,h] right
# l:left, b:bottom, w:width, h:height; in normalized unit (0-1)
cbax = fig.add_axes([0.89, 0.21, 0.03, 0.31])

cbax.set_title('Percentage \n of Ag Legislation \n (1975-2021)', **hfont,
               fontdict={'fontsize': '12', 'fontweight': '0'})

# add color scale
sm = plt.cm.ScalarMappable(cmap=colormap, \
                           norm=plt.Normalize(vmin=vmin, vmax=vmax))
# reformat tick labels on legend
sm._A = []
#comma_fmt = FuncFormatter(lambda x, p: format(x/100, '0'))
```

Skip to main content

```
fig.colorbar(sm, cax=cbax, format=comma_fmt)
tick_font_size = 16
cbax.tick_params(labelsize=tick_font_size)
# annotate the data source, date of access, and hyperlink
ax.annotate("Data: Authors", xy=(0.5, .085), xycoords='figure fraction', fontsize=1

# create map
# Note: we're going state by state here because of unusual coloring behavior when t
for row in visframe.itertuples():
    if row.state not in ['AK', 'HI']:  # Exclude Alaska and Hawaii for this part
        vf = visframe[visframe.state == row.state]
        if pd.isna(row.ag_proportion):  # Check if the ag_proportion is NaN
            color = 'lightgrey'  # Set color to grey for missing data
        else:
            color = gdf.loc[gdf.state == row.state, 'value_determined_color'].iloc[
        vf.plot(color=color, linewidth=1.5, ax=ax, edgecolor='0.8')

# add Alaska
akax = fig.add_axes([0.4, 0.25, 0.2, 0.13])
akax.axis('off')
# polygon to clip western islands
polygon = Polygon([(-170, 50), (-170, 72), (-140, 72), (-140, 50)])
alaska_gdf = gdf[gdf.state == 'AK']
alaska_gdf.clip(polygon).plot(color=gdf[gdf.state == 'AK'].value_determined_color,
                              edgecolor='0.8')

# add Hawaii
hiax = fig.add_axes([.58, 0.25, 0.1, 0.1])
hiax.axis('off')
`
# polygon to clip western islands
hipolygon = Polygon([(-160, 0), (-160, 90), (-120, 90), (-120, 0)])
hawaii_gdf = gdf[gdf.state == 'HI']

# Clip the Hawaii GeoDataFrame to the desired area
clipped_hawaii_gdf = hawaii_gdf.clip(hipolygon)

# Plot the clipped Hawaii GeoDataFrame using the 'value_determined_color' column fo
#color = hawaii_gdf['value_determined_color'].iloc[0] if not hawaii_gdf.empty else
clipped_hawaii_gdf.plot(ax=hiax, color='lightgrey', linewidth=0.8, edgecolor='0.8')

if variable == 'ag_proportion_0000':
    fig.savefig(os.path.join(os.getcwd(), './Outcomes/ag_legislation_1975_2021_0000
else:
    fig.savefig(os.path.join(os.getcwd(), './Outcomes/ag_legislation_1975_2021_0004

# bbox_inches="tight" keeps the vis from getting cut off at the edges in the saved
# dip is "dots per inch" and controls image quality.  Many scientific journals have
# https://stackoverflow.com/questions/16183462/saving-images-in-python-at-a-very-hi

plt.show()
```

Chapter 5 Sentiment analysis

sentiment analysis

Chapter 6 Conclusion

Chapter 7 Appendix