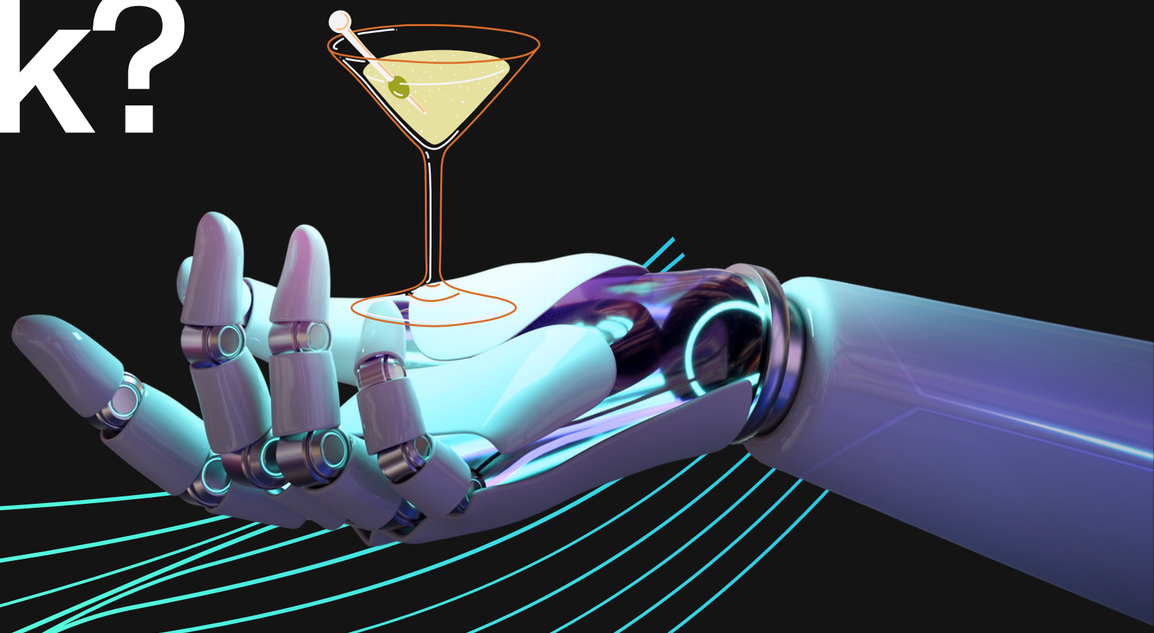
One more drink?

LEGAL DATA ANALYSIS - FINAL PROJECT



Outline

1. Goals and Approach
2. Phase 1 - Topic Modeling
3. Phase 2 - Throughout the Years
4. Conclusion

Goals and Approach

RESEARCH QUESTION

In what ways are French drinking habits impacted by French Law?

How do French legal databases reflect French drinking habits ?

Goals and Approach

PHASE 1 : PICKING A DATASET

- Cour de cassation ?
- Legifrance ?

PHASE 2 : SCRAPPING THE COUR DE CASSATION WEBSITE

- "Inspired" by Professor Charlotin's Github page

PHASE 3 :TOPIC MODELLING AND RESULTS

- Tried *(sometimes unsuccesfully)* to identify most important topics by using different methods

PHASE 4 : SCRAPPING LEGIFRANCE FOR A BROADER OVERVIEW

- Decided to go to Legifrance to include legislations

PHASE 5 : ANALYZING HOW IVRESSE HAS EVOLVED WITH THE LAW

- Plotted the evolution of ivresse in time : in the law, and in the jurisprudence

ALCOHOL IN FRENCH LAW THROUGHOUT THE YEARS

1873

First laws aiming to control drunkenesses

1970

First law against Drinking and Driving

1986

Introduces the possibility of immediate withdrawal of a driver's license

1991

Evin Law

Scrapping the Cour de Cassation website

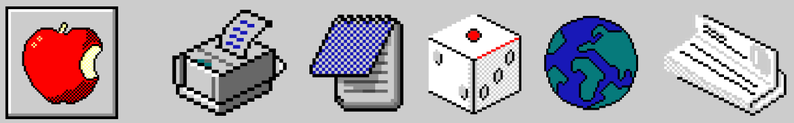
```
#=============================================================================================================================
#                                          SCRAPPING THE COUR DE CASSATION
#=============================================================================================================================

url = "https://www.courdecassation.fr/recherche-judilibre?search_api_fulltext=ivresse&op=Rechercher"
nlp = spacy.load('fr_core_news_md', disable=["tok2vec", "tagger", "parser", "attribute_ruler", "ner", "textcat"])

main_list = []
dds = []  # a container for the defaultdicts from the decisions
types = [] # keeping track of all categories of text in the database

webpage = requests.get(url) # we connect on the page with docs urls, page by page
soup = BeautifulSoup(webpage.content)

for i in range(79): # we iterate through all the pages
    print(i)
    if i != 0:
        new_url = "https://www.courdecassation.fr/recherche-judilibre?search_api_fulltext=ivresse&op=Rechercher&page=" + str(i)
        webpage = requests.get(new_url)
        soup = BeautifulSoup(webpage.content)
```



Back to Agenda Page

```python
for i in range(79): # we iterate through all the pages
    print(i)
    if i != 0:
        new_url = "https://www.courdecassation.fr/recherche-judilibre?search_api_fulltext=ivresse&op=Rechercher&page=" + str(i)
        webpage = requests.get(new_url)
        soup = BeautifulSoup(webpage.content)

    decisions = soup.find_all("div", class_="decision-item")  # And we find the list of docs urls

    for d in decisions:
        # Add link
        lien = d.find("a").get("href")
        sublist = [lien]

        # Add title
        title = d.find("h3").text.split("-\n")  # We split to obtain the relevant subelements in the title

        formation = d.find("p", class_="decision-item-header--secondary").text.split("-")[0]
        solution = d.find("p", class_="decision-item-header--secondary solution").text

        for x in title + [formation, solution]:   # And we add all this to our sublist
            sublist.append(x.strip())

        # Navigate to every decision
        webpage = requests.get("https://www.courdecassation.fr" + lien)

        soup = BeautifulSoup(webpage.content)
        textt = soup.find("div", class_="decision-content decision-content--main")

        text = soup.find("div", class_="decision-content decision-content--main").getText() # To fetch the text of the decision

        peuple = re.search("AU NOM DU PEUPLE", text)  # Cutting if text is too long, and we prefer to cut the entête rather than the text

        sublist.append(text[peuple.start():6000]) if peuple is not None else sublist.append(text[:5000])  # A 5000 max length is legit

        main_list.append(sublist)  # Adding to main_list, which is thus a list of lists, with each sublist corresponding to a case

        dd = defaultdict(str)  # We create a defaultdict to make sure that new entries will be an empty string
        current_type = "" # variable to keep track of the header

        for el in soup.find_all(["h3", "p"]):
            if el.name == "h3" and el.find("button") is not None:
                current_type = el.find("button").getText().strip()
                if current_type not in types:
                    types.append(current_type)
            elif el.name == "p" and "id" in el.attrs:  # We make sure this is a "p" element, as some h3 elements without button subels should not be taken into account
                dd[current_type] += el.getText().strip() + "\n-----\n"
        dds.append(dd)
```

Scrapping the Cour de Cassation website

```
        for el in soup.find_all(["h3", "p"]):
            if el.name == "h3" and el.find("button") is not None:
                current_type = el.find("button").getText().strip()
                if current_type not in types:
                    types.append(current_type)
            elif el.name == "p" and "id" in el.attrs:  # We make sure this is a "p" element, as some h3 elements without button subels should not be taken into account
                dd[current_type] += el.getText().strip() + "\n-----\n"
        dds.append(dd)


for e, d in enumerate(dds):
    for tt in types:
        data = d[tt]
        main_list[e].append(data[:5000])

cassdf = pd.DataFrame(main_list, columns=["URL", "Date", "Cour", "ID", "Formation", "Solution", "Text"] + types)
```

Topic Modeling

Goal : Identifying whether certain topics are particularly present in French breaches to the law in terms of drinking

4 Main Steps :

- Process the text with Spacy
- Word Cloud
- Latent Dirichlet Allocation (LDA)
- BERT

Topic Modeling

- Process the text with Spacy

Banned Words

```
banned_words = [ "publique", "palais", "justice", "base", "légale", "état", "ivresse", "alcoolique","avocat", "général", "peuple", "français", "débats", "article", "audience", "chambre", "conseiller", "cour", "président", "cour cassation", "arrêt", "code", "procédure", "juridiction", "moyen", "pourvoi", "cassation", "appel", "arret"]
```

```
#=============================================================================================
#                                          TOPIC MODELLING
#=============================================================================================

# STEP 1 : process text using spacy

def spacy_process(text):  # We first prepare the text by using spacy's token elements to remove stop words and punctuation
    doc = nlp(re.sub(r"\(\)", " ", text))   # We transform the text with spacy

    filtered_sentence = []   # Empty list for the tokens we'll want to keep

    punctuations = ["?",":","!",".",",","'",";","_", "(", ")", "[", "]"]  # A list of punctuation
    banned_words = [ "publique", "palais", "justice", "base", "légale", "état", "ivresse", "alcoolique","avocat", "général", "peuple"

    for token in doc:

        if token.is_stop is False and token.lemma_ not in punctuations and token.is_alpha and token.text.lower() not in banned_words:
            filtered_sentence.append(token.lemma_)

    return " ".join(filtered_sentence)


# Apply the function to the text and store in newly created column CText
cassdf["CText"] = cassdf.Text.apply(spacy_process)
```

Topic Modeling

- Word Cloud 

```
# STEP 2 : visualize term frequency with word cloud

long_string = ','.join(list(cassdf["CText"].values))
wordcloud = WordCloud(background_color="white", max_words=5000, contour_width=3, contour_color='blue').generate(long_string)

plt.imshow(wordcloud, interpolation = "bilinear")
plt.axis("off")
plt.show()
```

WordClouds...


alcoo
ivres
général
conduite empire
palais justice
infraction
pris
base légale justice


prévenu
statuant
formé
motivation mémoire
suspension permis
tenue
violation
nom francais
conduite véhicule
emprisonnement


tenue
conduite empire
motifs
évenu
mois
statuant
infraction
mis condu
décision
motivation mémoire
produit
is violat
iminelle


permis conduire
pris violation
criminelle tenue
prévenu
statuant
xpart
tenue paris
été
formé
unique pris
victime
rendu rapport
mois emprisonnement
faits
infraction
texte décision
motivation mémoire
nom francais
suspension permis
hon
z
salarié
conducteur
défaut motif
civile professionnelle
francais criminelle
conduite empire
motifs manque
conduite véhicule
accident
heure
annulation permis
emprisonnement sursis
observations société
assureur
condamné mois
francs amende
correctionnelle date
absence
condition
mémoire produit
bien
jour mois
dernier
société civile
partie civile
tribunal correctionnel
garde vue
juge
ailleurs
motif
déclaration
rapporteur greffier
pénale défaut
prononcé criminelle
employeur
jugé prononcé

Topic Modeling

```
# STEP 3 : topic modeling with LDA. Source : https://medium.com/analytics-vidhya/modeling-with-latent-dirichlet-allocation-3b198f1a7bae
def lda_topic_model(cassdf):

    count = CountVectorizer(max_df=.1, max_features=5000)
    X = count.fit_transform(cassdf["CText"].values)

    lda = LatentDirichletAllocation(n_components=10,random_state=123, learning_method= "batch")
    X_topics = lda.fit_transform(X)

    n_top_words = 5
    feature_names = count.get_feature_names()

    for topic_idx, topic in enumerate(lda.components_):
        print("Topic %d:" % (topic_idx + 1))
        print(" ".join([feature_names[i]
        for i in topic.argsort()
            [:-n_top_words - 1:-1]]))


lda_topic_model(cassdf) # call the lda function
```

- Latent Dirichlet Allocation (LDA)

LDA results

Topic 1: *assuré fausse risque intentionnelle axa*

Topic 2: *notification garde épreuve autorité air*

Topic 3: *accusation coups instruction volontaires assises*

Topic 4: *épouse divorce mari époux monsieur*

Topic 5: *garde débits audition policiers interpellation*

Topic 6: *caisse demeurant employeur grave primaire*

Topic 7: *clause exclusion assuré décès existe*

Topic 8: *analyse gendarmes maîtrise prélèvement chaussée*

Topic 9: *salarié licenciement employeur entreprise règlement*

Topic 10: *procedure defaut prevenu vehicule penale*

Topic Modeling

- BERT

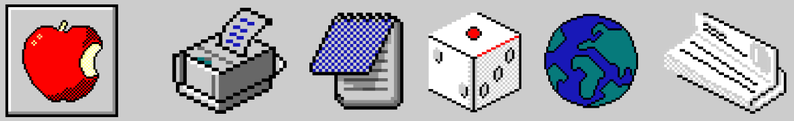
```
# STEP 4 : topic modeling with BERT. Source : class GitHub
def bert_topic_model(cassdf):

    topic_model = BERTopic(embedding_model=nlp, n_gram_range=(1, 3), min_topic_size=3, nr_topics="auto")  # We set up the topic model
    time.sleep(4)
    topics, probs = topic_model.fit_transform(cassdf.CText.values.tolist())

    topic_model.get_topic_info()  # We visualise the top terms for each topics
    cassdf["Topic"] = topics
    cassdf.to_clipboard(index=False, encoding="utf8")

    fig = topic_model.visualize_topics()
    pio.show(fig)


bert_topic_model(cassdf) # call the bert function
```



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BERT results (the most relevant ones)

Topic 1
Words: état | véhicule | conduite | alcoolique | mois
Size: 110

Topic 2
Words: contrat | travail | société | salarié | licenciement
Size: 106

Topic 5
Words: arret | responsabilite | faute | accident | victime
Size: 18

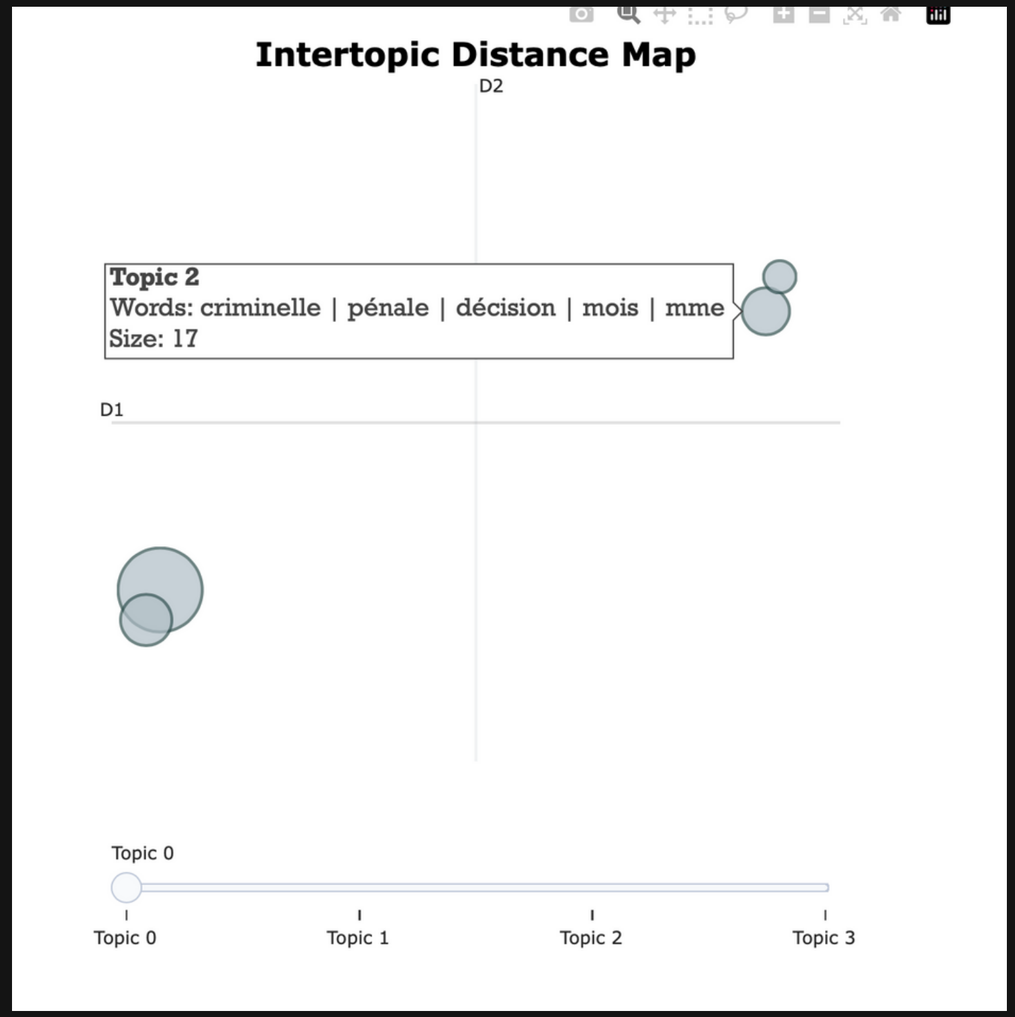
Topic 6
Words: violences | coups | été | faits | victime
Size: 18

The proces

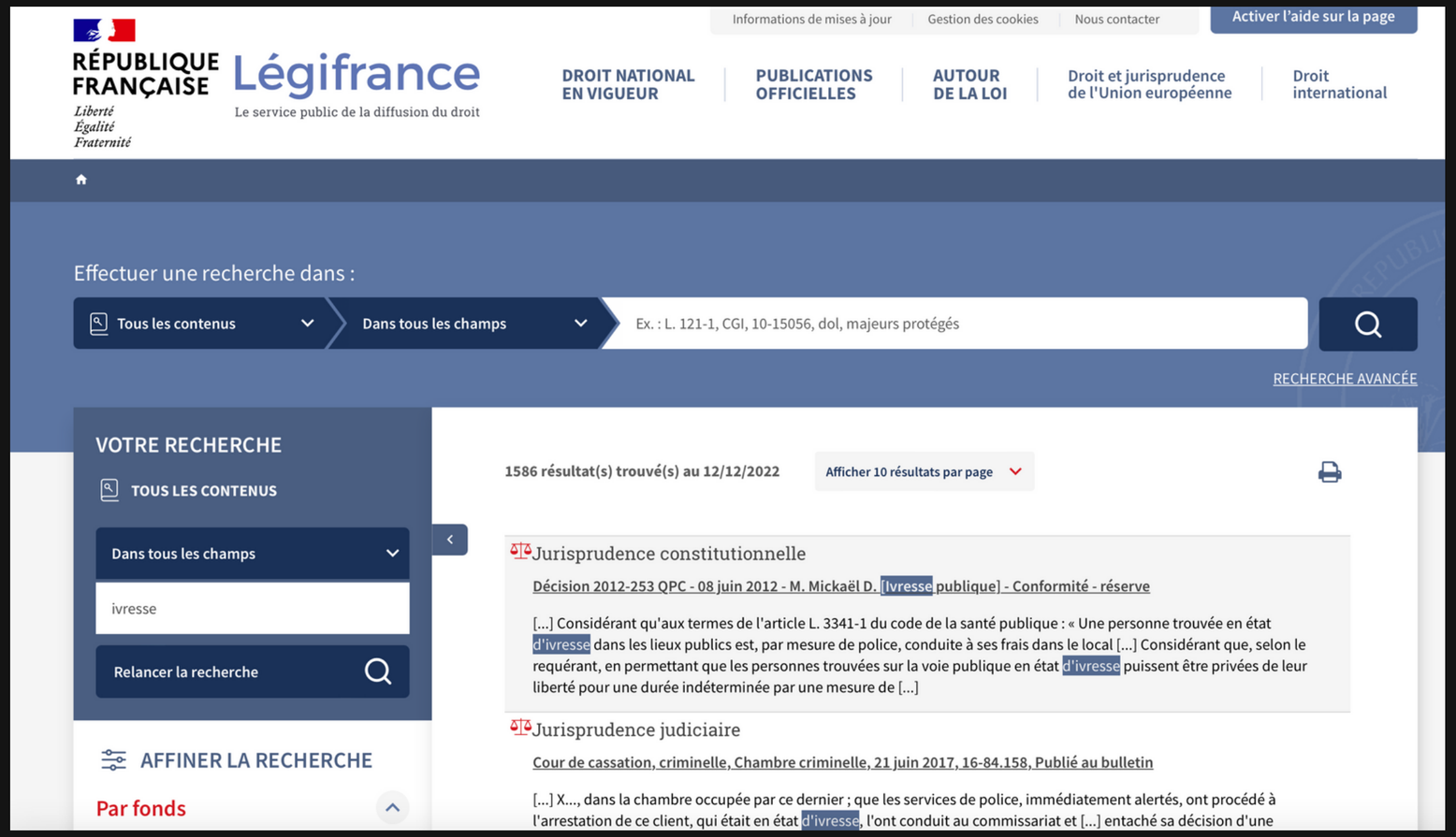
Last results we got were less relevant...

Overall topic modeling results :

- **drinking and driving...**
- **domestic violence**
- **workplace issues**



PART 2 Trying to establish a link between drinking laws and jurisprudence with Legifrance



Scrapping Legifrance

- setting up the scrapping : links and empty lists

```
data_scrapped = []

lien_ivresse = "https://www.legifrance.gouv.fr/search/all?tab_selection=all&searchField=ALL&query=ivresse&page=1&init=true"
lien_part1 = "https://www.legifrance.gouv.fr/search/all?tab_selection=all&searchField=ALL&query=ivresse&searchProximity=&searchType=ALL&isAdvancedResult=&isAdvancedRe
lien_part2 = "&tab_selection=all"

driver = webdriver.Chrome(service=Service(ChromeDriverManager().install()))

entry_list = []
list_of_lists = []
base_link = "https://www.legifrance.gouv.fr"
```

```python
for i in range(1,160):
    print(i)
    lien = lien_part1 + str(i) + lien_part2
    time.sleep(1)
    driver.get(lien_part1 + str(i) + lien_part2)  # Get the specific law code we are interested, using the dict defined above
    time.sleep(1)
    soup = BeautifulSoup(driver.page_source, features = "lxml")  # Read HTML, pass it to a soup object
    results= soup.find_all(class_= "result-item")
    for result in results:  # Iterate over articles one by one
        # EXTRACT LINK AND GET TEXT ON PAGE
        if(result.find("a")["href"]):
            entity_link = base_link + result.find("a")["href"]
            driver.get(entity_link)
            """
            try:
                our_text = driver.find_elements(By.CLASS_NAME, 'content-page').text
            except:
                try:
                    our_text = driver.find_elements(By.XPATH, '//*[@id="main"]/div/div/div[2]/div[4]/div').text
                except:
                    our_text = "No text found"""
        else:
            entity_link ="NA"

        # EXTRACT TITLE
        if len(result.find_all("a", class_ = "name-result-item")) != 0:
            title = result.find_all("a", class_ = "name-result-item")[0].text
        else:
            title = "NA"

        # EXTRACT CATEGORY
        if result.find_all("a"):
            catégorie = result.find_all("a")[0].text

        # EXTRACT DATE : either in title or in category
        if re.search("\d{2}/\d{2}/\d{4}",title):
            date = re.findall("\d{2}/\d{2}/\d{4}",title)[0]

        elif re.search("\d{1,2}\s[a-zà-ü]{3,9}\s\d{4}",title):
            date = re.findall("\d{1,2}\s[a-zà-ü]{3,9}\s\d{4}", title)[0]

        elif re.search("\d{1,2}\s[a-zà-ü]{3,9}\s\d{4}",catégorie):

            date = re.findall("\d{1,2}\s[a-zà-ü]{3,9}\s\d{4}",catégorie)[0]
        else:
            date = "NA"
        # CREATE LIST WITH EXTRACTED DATA
        our_list = [catégorie, entity_link, title, date] # our text removed at end
        list_of_lists.append(our_list)
driver.close()
df = pd.DataFrame(list_of_lists, columns=["Category", "Link", "Title", "Date"]) # text removed at end
df.to_csv("ivresse.csv", encoding="utf8")
```

Scrapping Legifrance

- trying to extract information from Legifrance : a failed attempt at extracting text from every page

```
for i in range(1,160):
    print(i)
    lien = lien_part1 + str(i) + lien_part2
    time.sleep(1)
    driver.get(lien_part1 + str(i) + lien_part2)  # Get the specific law code we are interested, using the dict defined above
    time.sleep(1)
    soup = BeautifulSoup(driver.page_source, features = "lxml")  # Read HTML, pass it to a soup object
    results= soup.find_all(class_= "result-item")
    for result in results:  # Iterate over articles one by one
        # EXTRACT LINK AND GET TEXT ON PAGE
        if(result.find("a")["href"]):
            entity_link = base_link + result.find("a")["href"]
            driver.get(entity_link)
            """
            try:
                our_text = driver.find_elements(By.CLASS_NAME, 'content-page').text
            except:
                try:
                    our_text = driver.find_elements(By.XPATH, '//*[@id="main"]/div/div/div[2]/div[4]/div').text
                except:
                    our_text = "No text found"""
        else:
            entity_link ="NA"
```

Scrapping Legifrance

- finding information part 2 and putting everything into a dataframe

```
        # EXTRACT CATEGORY
        if result.find_all("a"):
            catégorie = result.find_all("a")[0].text

        # EXTRACT DATE : either in title or in category
        if re.search("\d{2}/\d{2}/\d{4}",title):
            date = re.findall("\d{2}/\d{2}/\d{4}",title)[0]

        elif re.search("\d{1,2}\s[a-zà-ü]{3,9}\s\d{4}",title):
            date = re.findall("\d{1,2}\s[a-zà-ü]{3,9}\s\d{4}", title)[0]

        elif re.search("\d{1,2}\s[a-zà-ü]{3,9}\s\d{4}",catégorie):

            date = re.findall("\d{1,2}\s[a-zà-ü]{3,9}\s\d{4}",catégorie)[0]
        else:
            date = "NA"
        # CREATE LIST WITH EXTRACTED DATA
        our_list = [catégorie, entity_link, title, date] # our text removed at end
        list_of_lists.append(our_list)
driver.close()
df = pd.DataFrame(list_of_lists, columns=["Category", "Link", "Title", "Date"]) # text removed at end
df.to_csv("ivresse.csv", encoding="utf8")
```

```
#==============================================================================
# DATA CLEANING
#==============================================================================

df = pd.read_csv("ivresse.csv", encoding = "utf8", header = "infer")
print(df.head())

# We also delete the empty columns.
df = df.drop(["Unnamed: 0"], axis=1)

df = df.dropna(how = 'all')


# TRANSFORM DATES INTO DATE TIME OBJECTS !!
format_data = "%d/%m/%Y"
for index, el in df["Date"].items():
    if type(el) == str:
        if re.search("\d{1,2}/\d{2}/\d{4}",el):
            df["Date"][index] = datetime.strptime(el, format_data).date()

        else:
            df["Date"][index] = dateparser.parse(el).date()
            #el = datetime.strptime(el, format_data)


df["Year"] = 0 # default number
# Add a column with year :
for index, el in df["Date"].items():
    if(type(el) != float):
        df["Year"][index] = el.year
```

Some necessary Data Cleaning

```
#============================================================
#PART 2 = TIME ANALYSIS -- THE EVOLUTION
#============================================================

# create larger categories

new_df = pd.DataFrame()
new_list = []

for index, el in df["Category"].items():
    print(el)
    sublist = []
    if "jurisprudence" in el.lower() or "décision" in el.lower():
        print('yes')
        sublist.append("Jurisprudence")
        sublist.append(df["Year"][index])

    elif "loi" in el.lower():
        sublist.append("Laws")
        sublist.append(df["Year"][index])
    else:
        pass
    new_list.append(sublist)


new_df = pd.DataFrame(new_list, columns=["Category", "Year"])
print(new_df.head())

new_df = new_df.dropna()
```

Time analysis

- Extracting relevant information
- Split into jurisprudence and laws

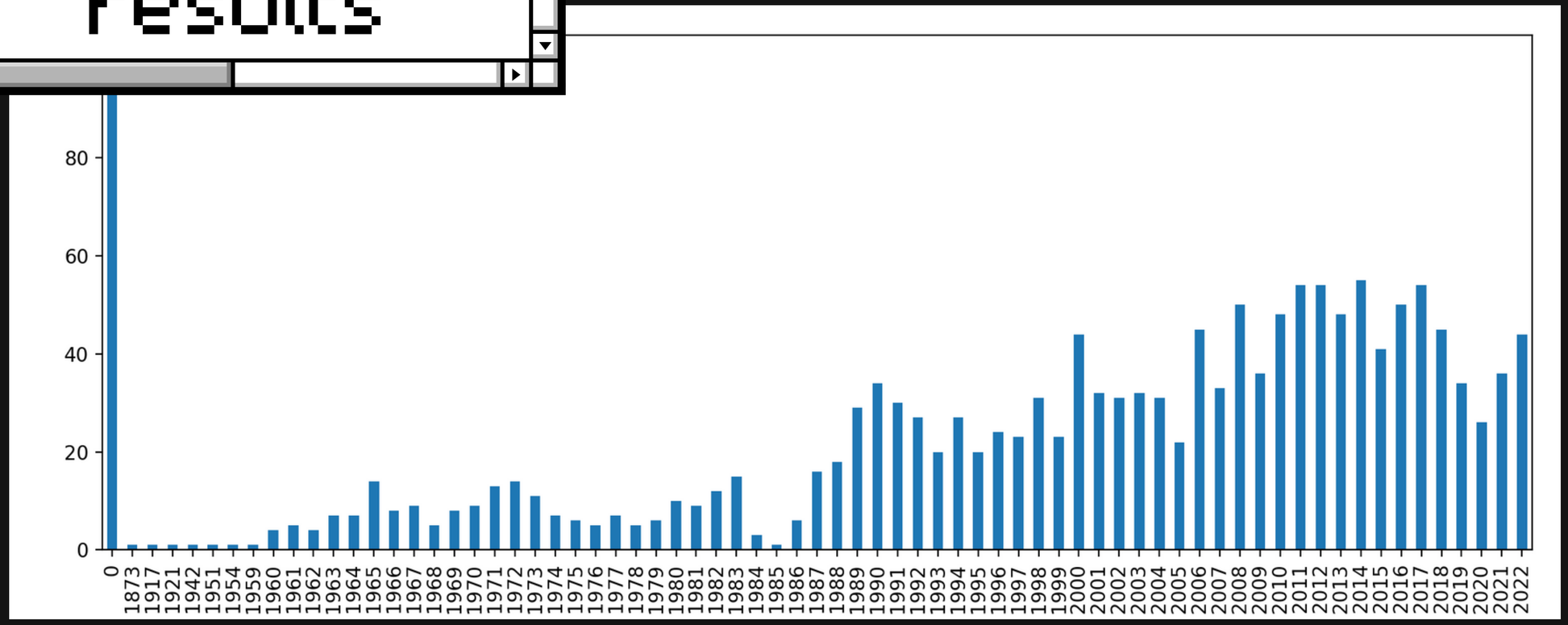
```
# Filter by jurisprudence or loi :

jp_filter = (new_df["Category"] == "Jurisprudence")
jp_df = new_df[jp_filter]

laws_filter = (new_df["Category"] == "Laws")
laws_df = new_df[laws_filter]


jp_df.groupby("Year").size().plot(kind = 'bar')

plt.show()

laws_df.groupby("Year").size().plot(kind = 'bar')
plt.show()
```

Filter
Then plot

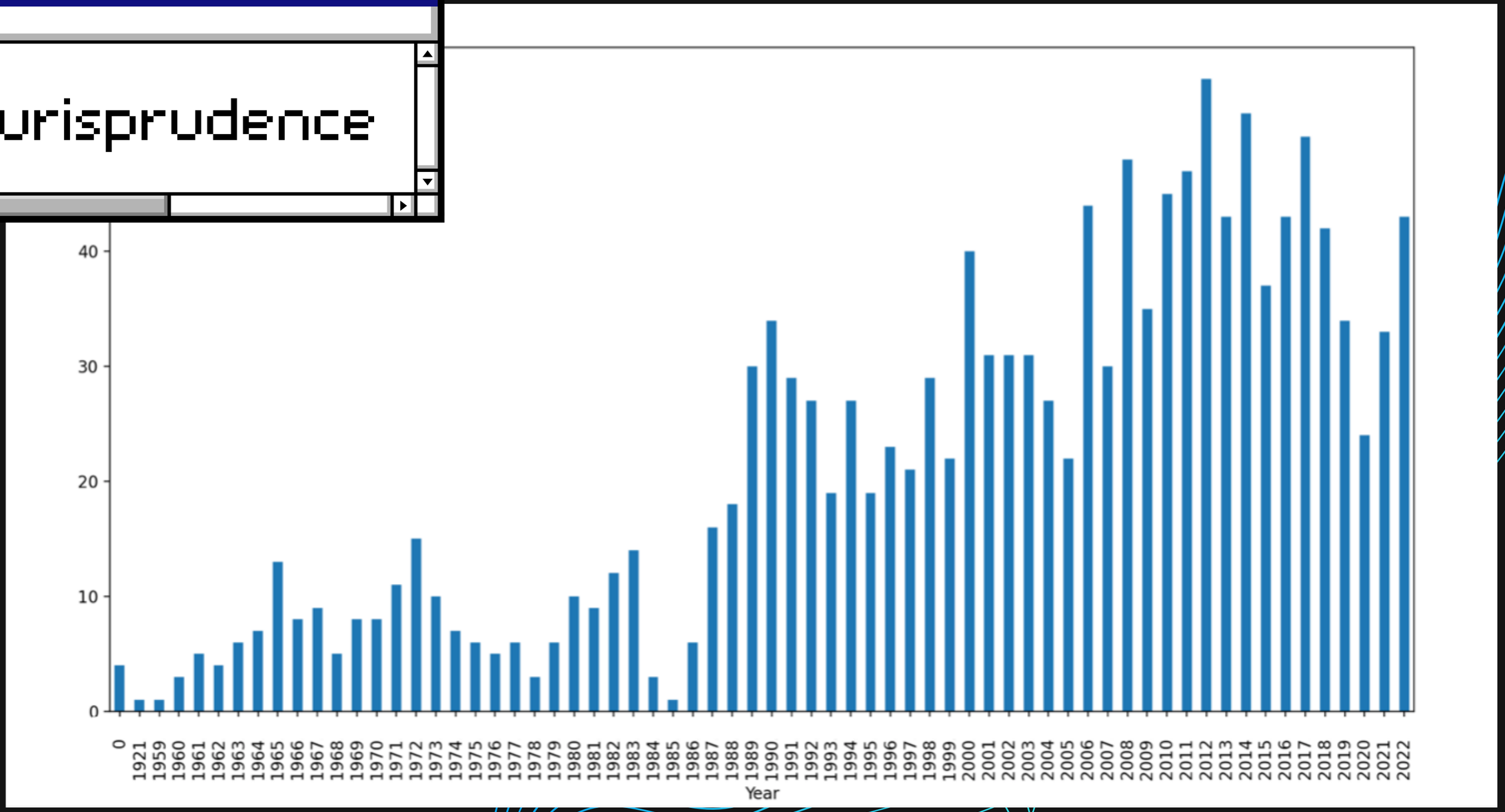
Area for improvement :
tried to plot all on the same graph, but it was complicated because there are way less laws than jurisprudence

previous results

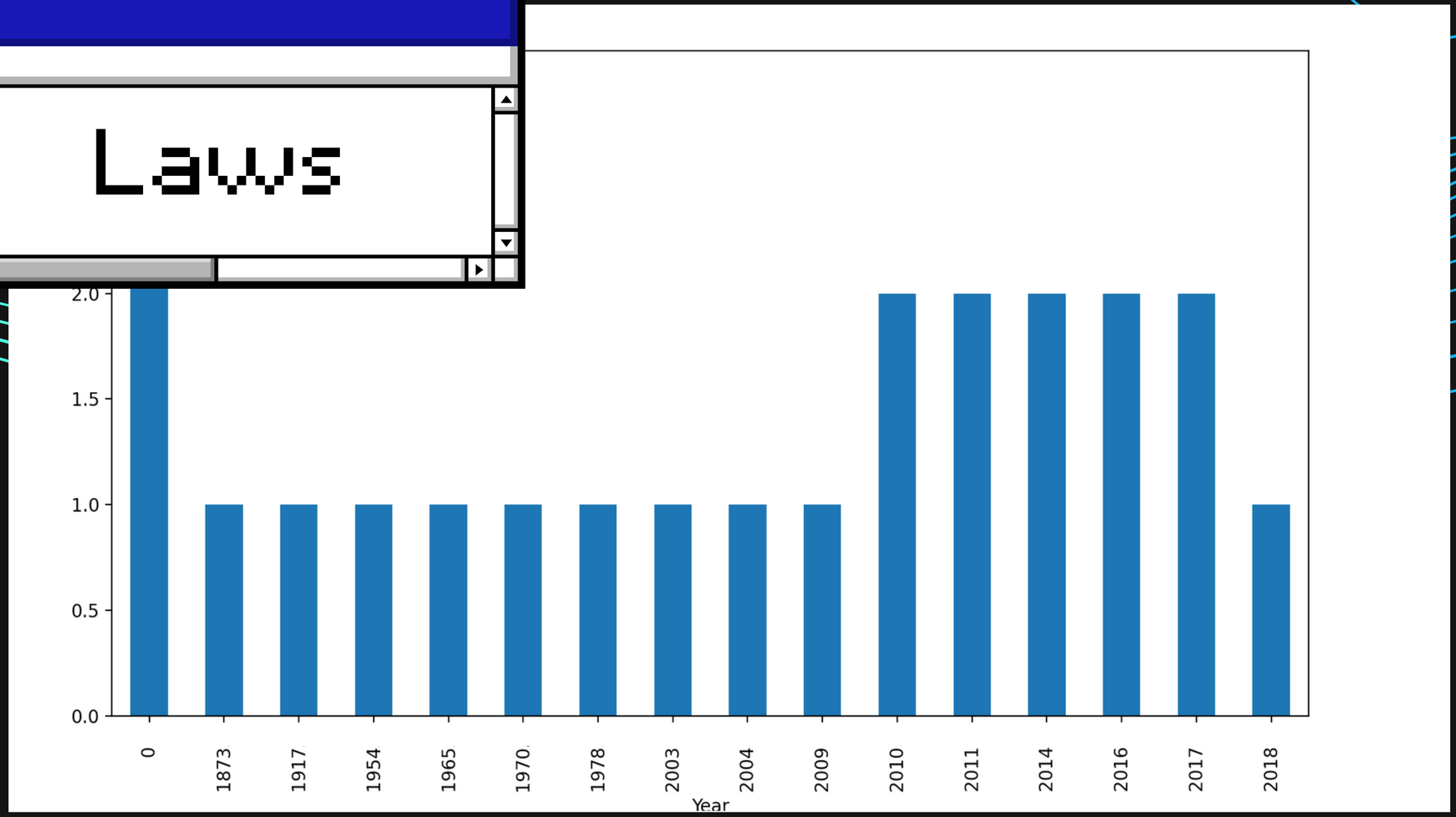
Results with all the data from Legifrance



Jurisprudence



Laws


2.0
1.5
1.0
0.5
0.0
0
1873
1917
1954
1965
1970
1978
2003
2004
2009
2010
2011
2014
2016
2017
2018
Year

1873

First laws aiming to control drunkenesses

1970

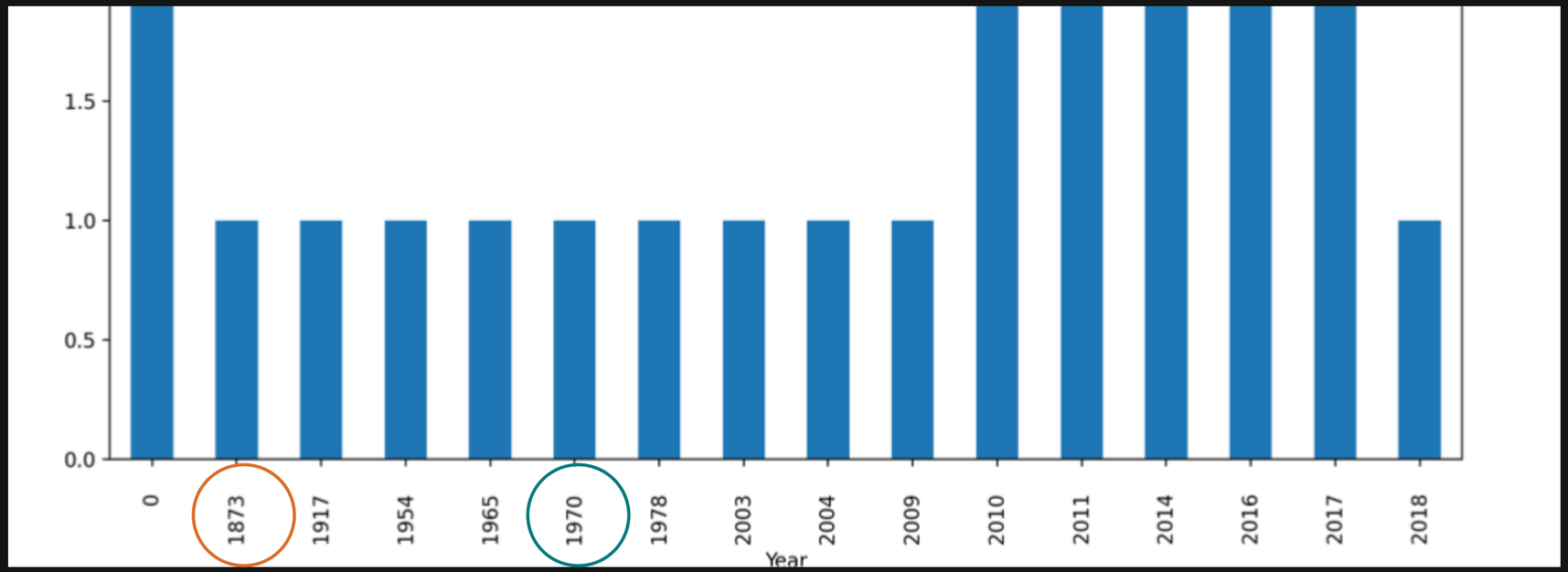
First law against Drinking and Driving

1986

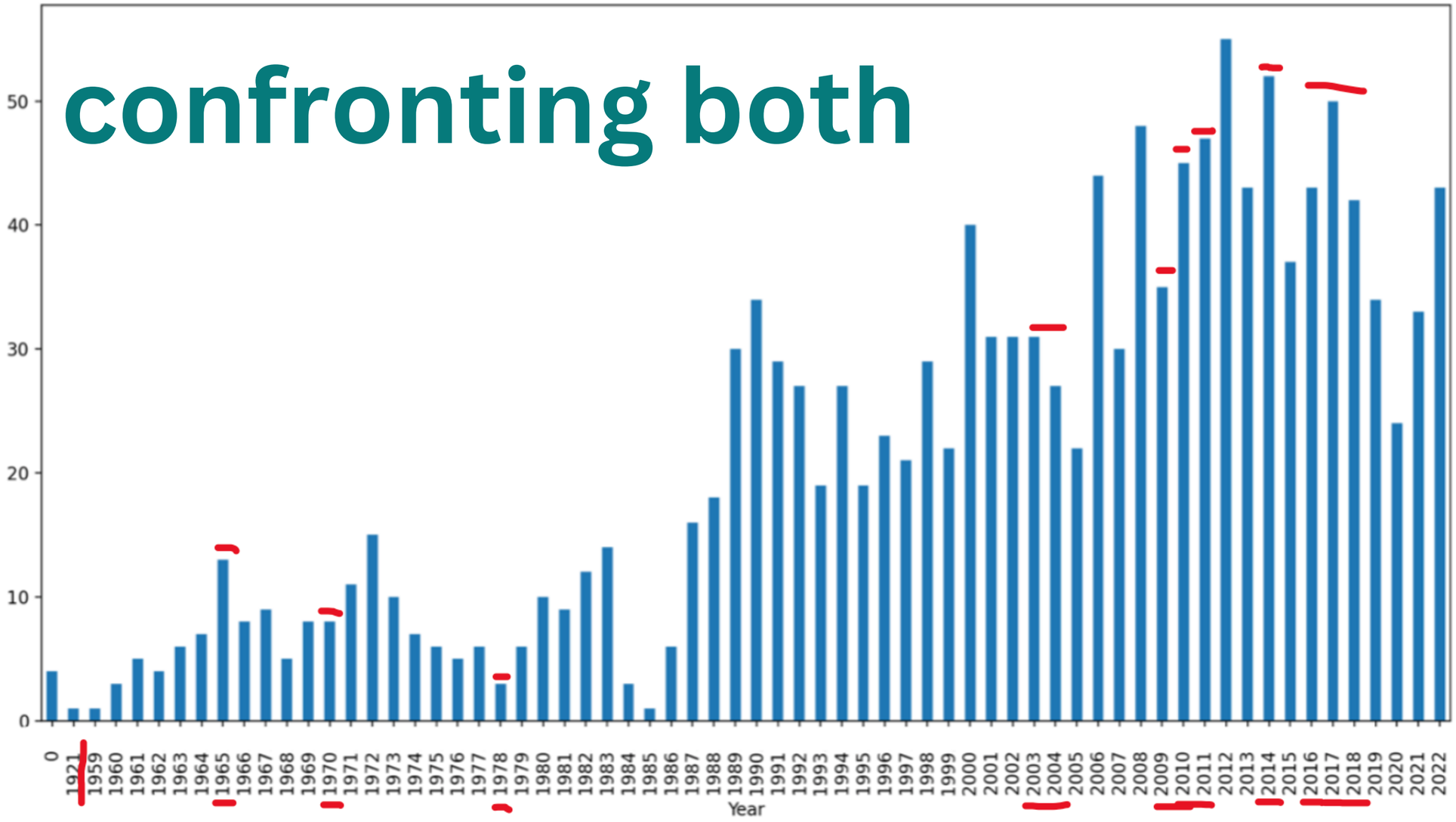
Introduces the possibility of immediate withdrawal of a driver's license

1991

Evin Law



confronting both



Conclusion

- some interesting results with topic modeling : drunk driving was unfortunately unsurprising...
- a time evolution algorithm that needs fine tuning... but some findings as well

Though our results fluctuated a lot, the numbers were always rising : result of more laws or more debauchery ?