In [1]:
```
import wordcloud as wc
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
from textblob import TextBlob
import nltk
import re
```

In [2]:
```
TRUMP = "Trump2017.txt"
OBAMA = "Obama2013.txt"
BUSH = "Bush2001.txt"
REAGAN = "Reagan1981.txt"
KENNEDY = "Kennedy1961.txt"
ROOSEVELT = "Roosevelt1941.txt"
P_NAMES = ["Trump - 2017", "Obama - 2013", "Bush - 2001", "Reagan - 1981", "Kennedy - 1961", "Roosevelt - 1941
PARTIES = {"Trump - 2017": "republican", "Obama - 2013": "democrat", "Bush - 2001": "republican", "Reagan - 19
           "Kennedy - 1961": "democrat", "Roosevelt - 1941": "democrat"}

# stopwords from https://gist.github.com/sebleier/554280
STOPWORDS = ["i", "me", "my", "myself", "we", "our", "ours", "ourselves", "you", "your", "yours", "yourself",
             "he", "him", "his", "himself", "she", "her", "hers", "herself", "it", "its", "itself", "they", "t
             "theirs", "themselves", "what", "which", "who", "whom", "this", "that", "these", "those", "am", "
             "was", "were", "be", "been", "being", "have", "has", "had", "having", "do", "does", "did", "doing
             "the", "and", "but", "if", "or", "because", "as", "until", "while", "of", "at", "by", "for", "wit
             "against", "between", "into", "through", "during", "before", "after", "above", "below", "to", "fr
             "in", "out", "on", "off", "over", "under", "again", "further", "then", "once", "here", "there", "
             "where", "why", "how", "all", "any", "both", "each", "few", "more", "most", "other", "some", "suc
             "not", "only", "own", "same", "so", "than", "too", "very", "s", "t", "can", "will", "just", "don"

# speeches from https://www.presidency.ucsb.edu/documents/app-categories/spoken-addresses-and-remarks/presiden
URLS = ["https://www.presidency.ucsb.edu/documents/inaugural-address-14",
        "https://www.presidency.ucsb.edu/documents/inaugural-address-15",
        "https://www.presidency.ucsb.edu/documents/inaugural-address-52",
        "https://www.presidency.ucsb.edu/documents/inaugural-address-11",
        "https://www.presidency.ucsb.edu/documents/inaugural-address-2",
        "https://www.presidency.ucsb.edu/documents/third-inaugural-address"]
```

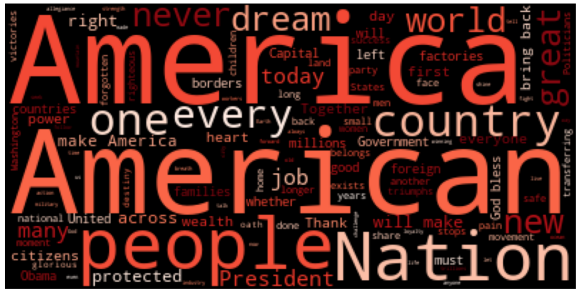
In [3]:
```
def readtext(filename):
    '''
    Read a text file into a string
    filename - the name of the file
    return - a string
    '''
    with open(filename, 'r', encoding="utf-8") as infile:
        return infile.read()
```

In [4]:
```
trump = readtext(TRUMP)
obama = readtext(OBAMA)
bush = readtext(BUSH)
reagan = readtext(REAGAN)
kennedy = readtext(KENNEDY)
roosevelt = readtext(ROOSEVELT)
presidents = [trump, obama, bush, reagan, kennedy, roosevelt]
```

In [5]:
```
def remove_stopwords(text, stopwords):
    '''
    remove stop words from given text and given list of stop words
    text - given text
    stopwords - list of stopwords
    return - list with cleaned up words
    '''
    # only match groups with alphanumerics or apostrophes
    words = re.findall(r"[\w']+", text)
    for word in words:
        if word in stopwords:
            words.remove(word)
    return " ".join(words)

# remove stopwords from all speeches
for i in range(len(presidents)):
    presidents[i] = remove_stopwords(presidents[i], STOPWORDS)
```

In [6]:
```
# Create cloud engines for republicans and democrats
cloud1 = wc.WordCloud(colormap = 'Reds',
        background_color = 'black')
cloud2 = wc.WordCloud(colormap = 'Blues',
        background_color = 'black')

# generate cloud image from each speech
rows = 3
cols = 2
fig = plt.figure(figsize=(12, 6), dpi=400)
for i in range(len(presidents)):
    if PARTIES[P_NAMES[i]] == "republican":
        p_cloud = cloud1.generate(presidents[i])
        fig.add_subplot(rows, cols, i + 1)
        plt.imshow(p_cloud)
        plt.title(P_NAMES[i], color="red")
        plt.axis('off')
    else:
        p_cloud = cloud2.generate(presidents[i])
        fig.add_subplot(rows, cols, i + 1)
        plt.imshow(p_cloud)
        plt.title(P_NAMES[i], color="blue")
        plt.axis('off')
```

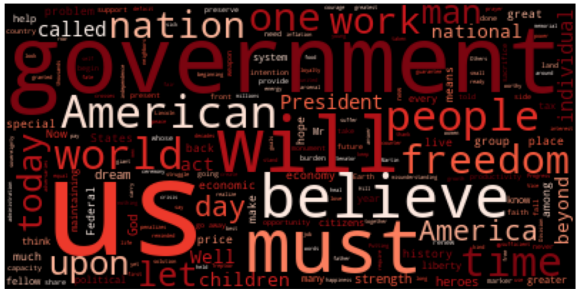
Trump - 2017



Obama - 2013

Bush - 2001

Reagan - 1981

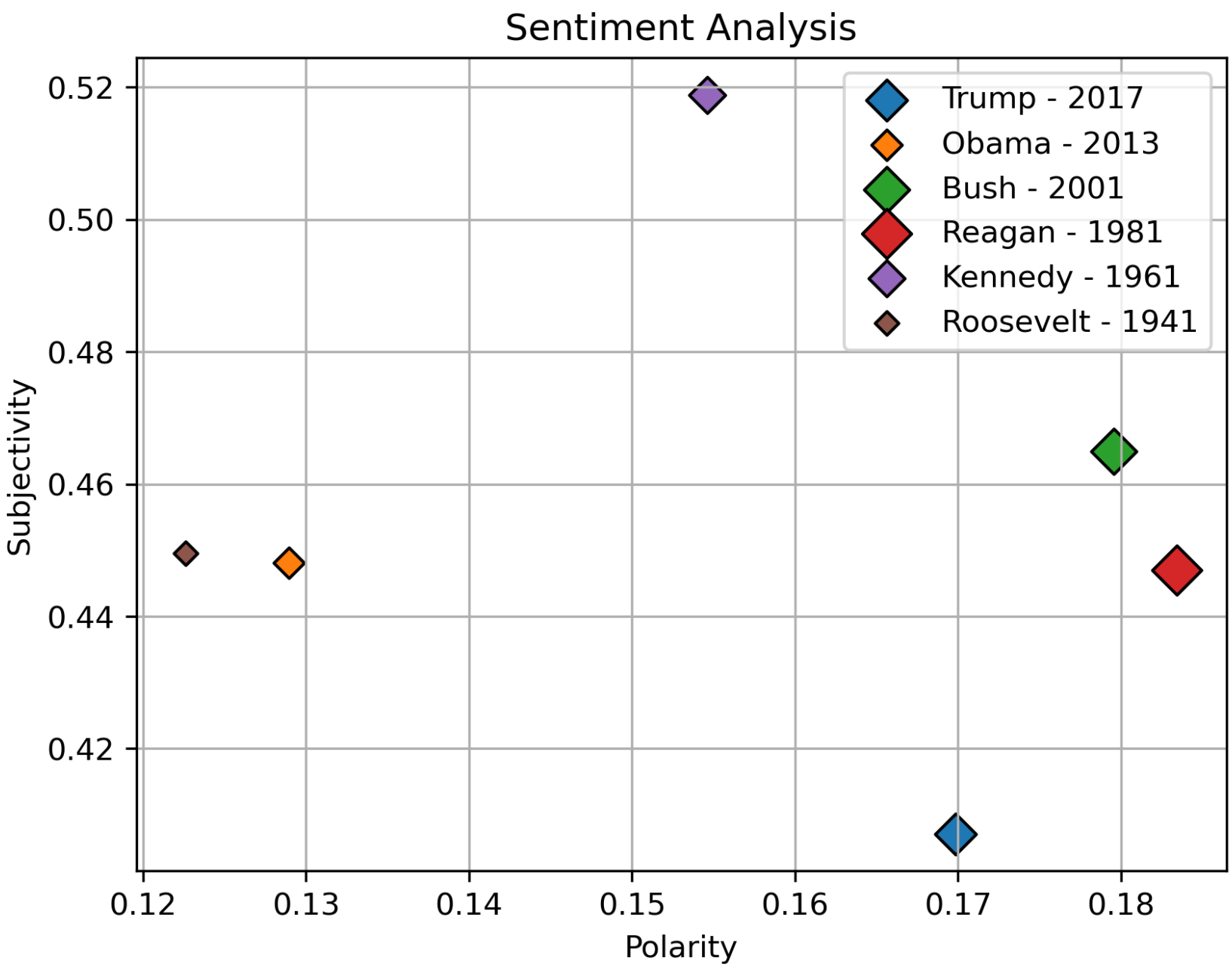


Kennedy - 1961

Roosevelt - 1941

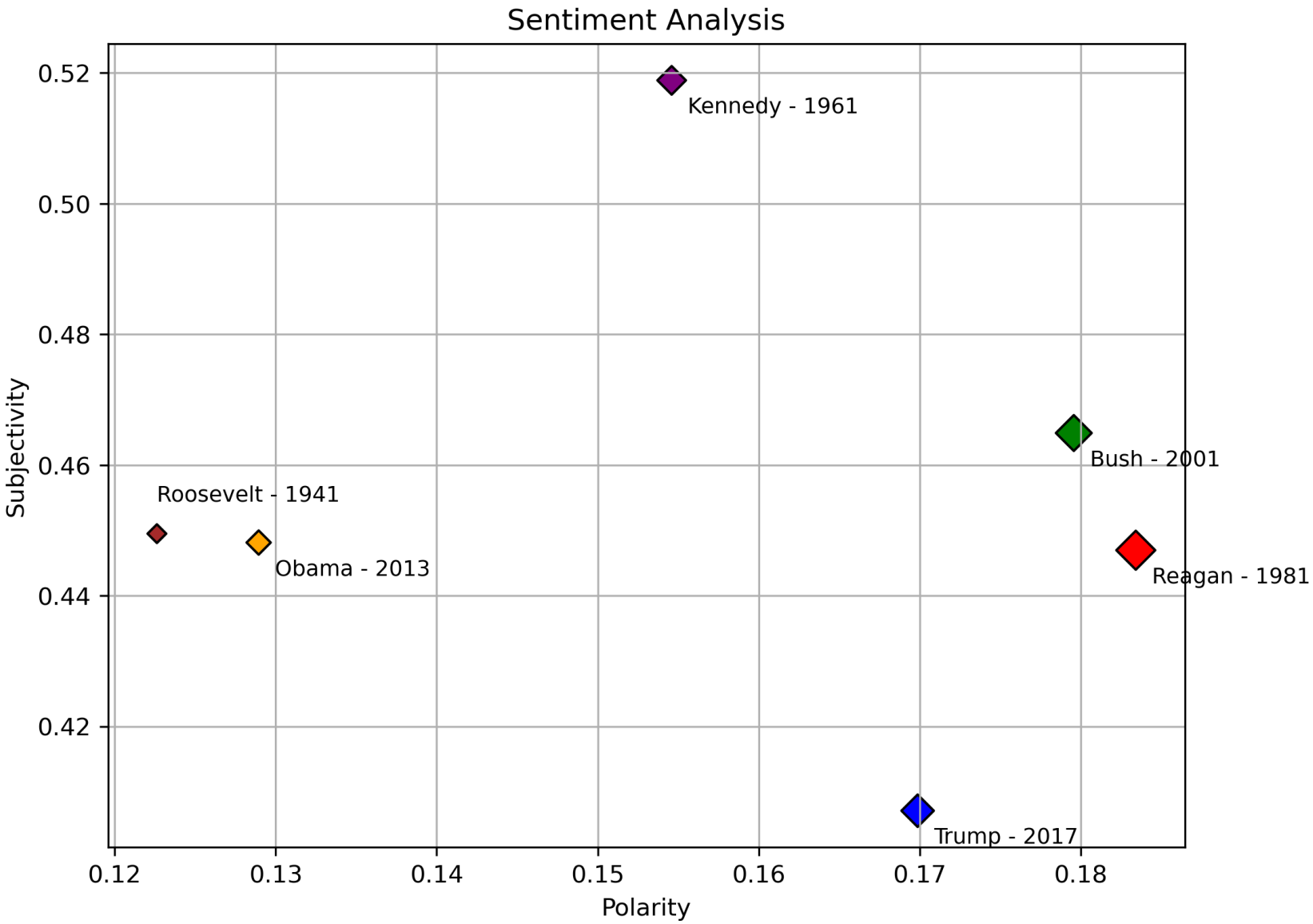
In [7]:
```
#  Polarity score vs. Subjectivity score plot (no hyperlinks)
fig = plt.figure(dpi=300)
area = {0: 90, 1: 50, 2: 110, 3: 130, 4: 70, 5: 30}
for i in range(len(presidents)):
    blob = TextBlob(presidents[i])
    s = plt.scatter(blob.sentiment.polarity, blob.sentiment.subjectivity, label=P_NAMES[i],
                marker="D", edgecolors="black", s=area[i])
plt.grid()
plt.title("Sentiment Analysis")
plt.xlabel("Polarity")
plt.ylabel("Subjectivity")
plt.legend()
```

Out[7]:
```
<matplotlib.legend.Legend at 0x2679aa9d0c0>
```


Sentiment Analysis
Trump - 2017
Obama - 2013
Bush - 2001
Reagan - 1981
Kennedy - 1961
Roosevelt - 1941
Subjectivity
0.52
0.50
0.48
0.46
0.44
0.42
0.12
0.13
0.14
0.15
0.16
0.17
0.18
Polarity

In [8]:
```
# The above plot reveals that out of all the speeches, Kennedy gave the most subjective one of them, and
# Trump gave the least subjective among them. The aforementioned speeches are also outliers when
# it comes to their subjectivity score since the remaining speeches have scores that fall in the 0.44-0.47
# range. We can also see that Reagan's speech overall had the most positive
# tone as opposed to Roosevelt's with a minimum polarity score of about 0.122
```

In [9]:
```
# Polarity score vs. Subjectivity score plot with links to each speech
area = [90, 50, 110, 130, 70, 30]
colors = ["blue", "orange", "green", "red", "purple", "brown"]
X, Y = [], []

# Fill lists
for i in range(len(presidents)):
    blob = TextBlob(presidents[i])
    X.append(blob.sentiment.polarity)
    Y.append(blob.sentiment.subjectivity)

# Create scatter plot
fig = plt.figure(figsize=(8,6), dpi=300)
s = plt.scatter(X, Y, marker="D", edgecolors="black", s=area, c=colors)

# Set links
s.set_urls(URLS)
plt.grid()
plt.title("Sentiment Analysis")
plt.xlabel("Polarity")
plt.ylabel("Subjectivity")

# Label points
for i in range(len(X) - 1):
    plt.text(X[i] + 0.001, Y[i] - 0.005, P_NAMES[i], fontsize=9)
plt.text(X[5], Y[5] + 0.005, P_NAMES[5], fontsize=9)
fig.savefig('scatter.svg')
```


Sentiment Analysis
Subjectivity
Polarity
0.52
0.50
0.48
0.46
0.44
0.42
0.12
0.13
0.14
0.15
0.16
0.17
0.18
Kennedy - 1961
Bush - 2001
Roosevelt - 1941
Obama - 2013
Reagan - 1981
Trump - 2017

In [10]:
```
# The above plot reveals that out of all the speeches, Kennedy gave the most subjective one of them, and
# Trump gave the least subjective among them. The aforementioned speeches are also outliers when
# it comes to their subjectivity score since the remaining speeches have scores that fall in the 0.44-0.47
# range. We can also see that Reagan's speech overall had the most positive
# tone as opposed to Roosevelt's with a minimum polarity score of about 0.122
```

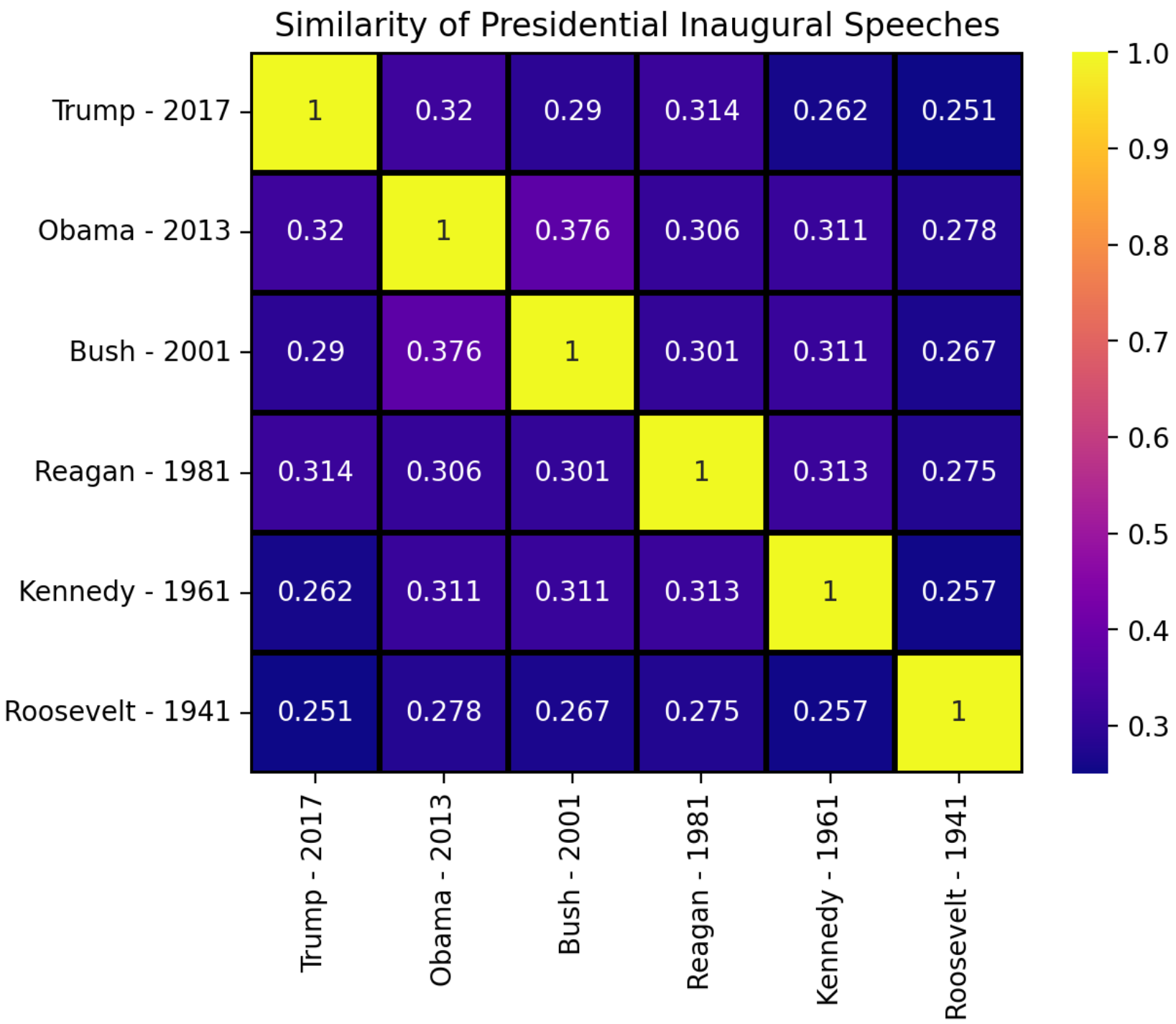
In [11]:
```
# Vector functions (from class)
def vectorize(words, unique):
    '''
    vectorize list of words based on unique set constraint
    words - list of words
    unique - set of unique words
    return - vectorized list
    '''
    vector = [1 if word in words else 0 for word in unique]
    return vector

def mag(v):
    """ Magnitude of a vector v
        v - vector in list component notation, e.g., [1, 5, -1]
        return - float
    """
    return sum([i ** 2 for i in v]) ** 0.5
def dot(u, v):
    """ dot product of two vectors
        u - vector 1
        v - vector 2
        return - float
    """
    return sum([i * j for i,j in zip(u,v)])

def cosine_similarity(u, v):
    """ Cosine similarity between two vectors
        u - vector 1
        v - vector 2
        return - float
    """
    cos_theta = dot(u,v) / (mag(u) * mag(v))
    return cos_theta
```

In [12]:
```
# unique set of words of all speeches
presidents = [president.split() for president in presidents]
unique = set([word for president in presidents for word in president])
```

In [13]:
```
# An nxn array of cosine similarities
# arr[i, j] measures the similarity between speech i and speech j by first vectorizing each speech,
# then computing cosine similarities between all speeches, and finally storing each similarity in array
n = len(presidents)
arr = np.ones((n, n))
for i in range(n):
    vi = vectorize(presidents[i], unique)
    for j in range(i+1, n):
        vj = vectorize(presidents[j], unique)
        arr[i, j] = cosine_similarity(vi, vj)
        arr[j, i] = arr[i, j]
```

In [14]:
```
# plot heatmap of cosine similarities' array
fig = plt.figure(dpi=200)
sns.heatmap(arr, annot=True, fmt='.3g', xticklabels=P_NAMES, cmap="plasma", yticklabels=P_NAMES,
            linewidth=2, linecolor="black")
plt.title("Similarity of Presidential Inaugural Speeches")
```

Out[14]:
```
Text(0.5, 1.0, 'Similarity of Presidential Inaugural Speeches')
```


Similarity of Presidential Inaugural Speeches
Trump - 2017
Obama - 2013
Bush - 2001
Reagan - 1981
Kennedy - 1961
Roosevelt - 1941
1 0.32 0.29 0.314 0.262 0.251
0.32 1 0.376 0.306 0.311 0.278
0.29 0.376 1 0.301 0.311 0.267
0.314 0.306 0.301 1 0.313 0.275
0.262 0.311 0.311 0.313 1 0.257
0.251 0.278 0.267 0.275 0.257 1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3

In [15]:
```
# Heatmap reveals that Roosevelt's speech is the most different compared to all other speeches given that
# it's the oldest speech of the list. In particular, Trump's and Roosevelt's speeches have a similarity
# of 0.251 which is the lowest similarity of the plot. This makes sense as Roosevelt's speech was given more
# than 80 years ago, and the problems the US was facing then were likely much different than the ones
# Trump was trying to ammend.
# We can also see that the highest similarity is of 0.376 between Obama's and Bush's speeches. I found it
# interesting given that 12 years went by after Bush gave his speech, and because of the fact that both
# presidents made part of different parties.
```