NLP with Python: exploring Fate/Zero

Extracting information from texts can be useful in many ways, for example: finding main entities in texts, finding important information in a corpus, comparing texts, extracting main ideas, deducing author's writing style and many others things. Most of these tasks could be performed manually, but with spending condiderable amounts of time.

In this notebook I'll show how to do some of them with python.

For this task I use English translation of Japanese light novel "Fate/Zero", taken from this site.

The story of Fate/Zero details the events of the Fourth Holy Grail War in Fuyuki City. The Holy Grail War is a contest, founded by the powerful magic families centuries ago, in which seven mages summon seven Heroic Spirits to compete to obtain the power of the "Holy Grail", which grants a wish to each member of the winning duo. After three inconclusive wars for the elusive Holy Grail, the Fourth War commences.

I downloaded the text and saved it in four files (one for each volume). Here is the content of the notebook:

In [1]:
```
import nltk
from nltk.tokenize import RegexpTokenizer
from nltk.text import Text
from nltk.util import ngrams
from nltk.stem.wordnet import WordNetLemmatizer
import spacy
en_stop = spacy.en.STOPWORDS
nlp = spacy.load('en')

from wordcloud import WordCloud
import matplotlib.pyplot as plt
import matplotlib
import matplotlib.ticker as ticker
%matplotlib inline
from cycler import cycler
```

```
import re
import os
from scipy.misc import imread
from collections import Counter, defaultdict
```

Data Preparation

In [2]:
```
#fate_folder = 'Data various/Fate_Zero/'
files = [os.path.join(fate_folder, f) for f in sorted(os.listdir(fate_folder
files
```

Out[2]:
```
['Data various/Fate_Zero/1.txt',
 'Data various/Fate_Zero/2.txt',
 'Data various/Fate_Zero/3.txt',
 'Data various/Fate_Zero/4.txt']
```

In [3]:
```
#Let's see how does the text looks like.
open(files[1], 'r', encoding='UTF-8').read()[:1000]
```

Out[3]:
```
'\ufeffAct 5[edit]\n-150.39.43[edit]\n\nFurther removed to the west than Mi
yama town of Fuyuki, the winding state highway stretched westwards with its
back towards the city\'s lights. Meanwhile, an undeveloped piece of forest
waited for visitors further up the road. Continuing beyond even the prefect
ural border, the state highway silently meandered on.\n\nAlthough there wer
e two lanes on the road, no crossing cars can be seen even with the sparse
street lights. The state highway in the dead of night seemed to fade from m
emory and into the silence.\n\nIn such a silent night, a silver beast flew
by.\n\nMercedes-Benz 300SL Coupe. The flowing, elegant, streamlined body wi
th a scent of antiquity resembled a noble lady, while the roaring of the In
line-6 SOHC engine was like that of a fierce beast\'s. And behind the steer
ing wheel of the classic sedan recklessly going beyond 100 kilometers per h
our - were unexpectedly the slender wrists of a young lady.\n\n"Hey hey, th
is goes pretty fast, doesn\'t it?"\n\nIrisviel'
```

There are some special unicode characters in the text(\ufeff), useless data (-150.39.43), technical words from the page ([edit]) and sentences are separated by "\n\n".

The following code reads each file, splits text into sentences and cleans the text. The result is a list of four lists with sentences.

In [4]:
```
def read_files():
    skillRegex = re.compile((r'-\d\d\d.\d\d.\d\d'))
    for f in files:
        temp_data = open(f, 'r', encoding='UTF-8').read()
        temp_data = [i for i in temp_data.split('\n')]
        temp_data = [i.replace(skillRegex.search(i).group(),'') if skillRege
        temp_data = [i.replace('[edit]', '').replace('\ufeff', '') for i in
        yield temp_data
text_sentences = list(read_files())
text_sentences[1][:10]
```

Out[4]:
```
['Act 5',
 "Further removed to the west than Miyama town of Fuyuki, the winding state highway stretched westwards with its back towards the city's lights. Meanwhile, an undeveloped piece of forest waited for visitors further up the road. Continuing beyond even the prefectural border, the state highway silently meandered on.",
 'Although there were two lanes on the road, no crossing cars can be seen even with the sparse street lights. The state highway in the dead of night seemed to fade from memory and into the silence.',
 'In such a silent night, a silver beast flew by.',
 "Mercedes-Benz 300SL Coupe. The flowing, elegant, streamlined body with a scent of antiquity resembled a noble lady, while the roaring of the Inline-6 SOHC engine was like that of a fierce beast's. And behind the steering wheel of the classic sedan recklessly going beyond 100 kilometers per hour - were unexpectedly the slender wrists of a young lady.",
 '"Hey hey, this goes pretty fast, doesn\'t it?"',
 "Irisviel, who held the steering wheel and whose face was full of pleased smiles, said. Sitting in the passenger's seat, Saber's face was full of nervousness, and she barely managed to squeeze out a stiff smile and a nod.",
 '"In-Indeed, unexpectedly, this is...some rather... skillful... driving..."',
 '"Right? I had special training, even though it may not look like it."',
 "That being said, based on the unfamiliar way she dealt with the gears, she's far from being a proficient driver."]
```

In [5]:
```
#List of four lists with text.
text_lists = [' '.join(i) for i in text_sentences]
text_lists[1][:1000]
```

Out[5]:
```
'Act 5 Further removed to the west than Miyama town of Fuyuki, the winding state highway stretched westwards with its back towards the city\'s lights. Meanwhile, an undeveloped piece of forest waited for visitors further up the road. Continuing beyond even the prefectural border, the state highway silently meandered on. Although there were two lanes on the road, no crossing cars can be seen even with the sparse street lights. The state highway in the dead of night seemed to fade from memory and into the silence. In such a silent night, a silver beast flew by. Mercedes-Benz 300SL Coupe. The flowing, elegant, streamlined body with a scent of antiquity resembled a noble lady, while the roaring of the Inline-6 SOHC engine was like that of a fierce beast\'s. And behind the steering wheel of the classic sedan recklessly going beyond 100 kilometers per hour - were unexpectedly the slender wrists of a young lady. "Hey hey, this goes pretty fast, doesn\'t it?" Irisviel, who held the steering wheel '
```

In [6]:
```
#One cleaned text.
text = ' '.join(text_lists)
text[:1000]
```

Out[6]:
```
"Prologue 8 years ago Let us tell the story of a certain man. The tale of a
man who, more than anyone else, believed in his ideals, and was driven to d
espair by them. The dream of that man was pure. His wish was for everyone i
n this world to be happy; that was all that he asked for. It is a childish
ideal that all young boys grow attached to at least once, one that they aba
ndon once they grow accustomed to the mercilessness of reality. Any happine
ss requires a sacrifice, something all children learn when they become adul
ts. But, that man was different. Maybe he was just the most foolish of all.
Maybe he was broken somewhere. Or maybe, he might have been of the kind we
call 'Saints', entrusted with God's will. One that common people cannot und
erstand. He knew that for any existence in this world, the only two alterna
tives are sacrifice, or salvation... After understanding that, he would nev
er be able to empty the scale plates... From that day on, he set his mind t
o work on being the one "
```

In [7]:
```
#I'll also need a tokenized text.
text_tokens_lists = []
tokenizer = RegexpTokenizer(r'\w+')
lemma = WordNetLemmatizer()
for j in text_lists:
    tokens = tokenizer.tokenize(j.lower())
    stopped_tokens = [i for i in tokens if i not in en_stop]
    lemmatized = [lemma.lemmatize(i) for i in stopped_tokens]
    text_tokens_lists.append(lemmatized)

text_tokens = [j for i in text_tokens_lists for j in i]
```

In [8]:
```
#Parse text with spacy
nlp_text = nlp(text)
#For nltk
text_nltk = Text(text_tokens)
```

Character occurence in text

There are many ways to analyse text based on linguistics. But languages are complicated, often machine learning has lower accuracy than humans in correctly tagging the words.

For example let's try to find characters who are mentioned a lot in the text.

- At first I use spacy and try to find entities, who are considered to be persons;
- Then I find proper nouns, again with spacy;
- Next attempt is with nltk - finding various nouns;
- At last I simply find the most common words in the list of tokens;

In [9]:
```
def character_occurences(condition):
    if condition == 1:
        characters = Counter()
        for ent in nlp_text.ents:
            if ent.label_ == 'PERSON':
                characters[ent.lemma_] += 1
```

```
        return characters.most_common()

    if condition == 2:
        characters1 = Counter()
        for token in nlp_text:
            if token.pos_ == 'PROPN':
                characters1[token.lemma_] += 1
        return characters1.most_common()

    if condition == 3:
        tagged_tokens = nltk.pos_tag(text_tokens)
        characters2 = Counter()
        for token in tagged_tokens:
            if token[1] in ['NN', 'NNP', 'NNS']:
                characters2[token[0].lower()] += 1
        return characters2.most_common()

    else:
        counts = Counter(text_tokens)
        return counts.most_common()
```

In [10]:

```
print('Spacy. Person entities.')
print(character_occurences(1)[:20])
print('\n', 'Spacy. Pronouns.')
print(character_occurences(2)[:20])
print('\n', 'NLTK.')
print(character_occurences(3)[:20])
print('\n', 'Counts.')
print(character_occurences(4)[:20])
```

```
Spacy. Person entities.
[('saber', 805), ('kiritsugu', 764), ('kirei', 618), ('waver', 343), ('irisv
iel', 319), ('archer', 292), ('kayneth', 273), ('kariya', 251), ('maiya', 18
9), ('tokiomi', 168), ('berserker', 150), ('emiya kiritsugu', 122), ('lance
r', 99), ('ryūnosuke', 98), ('kotomine kirei', 94), ('caster', 93), ('assass
in', 84), ('aoi', 72), ('tōsaka', 67), ('masters', 59)]

 Spacy. Pronouns.
[('saber', 1373), ('kiritsugu', 1276), ('’s', 1222), ('kirei', 976), ('irisv
iel', 721), ('waver', 658), ('grail', 553), ('tokiomi', 480), ('master', 44
7), ('lancer', 444), ('kariya', 404), ('rider', 391), ('kayneth', 367), ('ho
ly', 364), ('servant', 345), ('archer', 337), ('maiya', 325), ('king', 305),
('tōsaka', 264), ('heroic', 254)]

 NLTK.
[('s', 1917), ('t', 1211), ('saber', 954), ('time', 944), ('kiritsugu', 87
9), ('kirei', 701), ('rider', 622), ('master', 605), ('hand', 589), ('man',
477), ('eye', 477), ('battle', 474), ('irisviel', 456), ('grail', 439), ('bo
dy', 410), ('heart', 409), ('thing', 395), ('lancer', 391), ('world', 353),
('word', 342)]

 Counts.
[('s', 4106), ('t', 1742), ('saber', 1429), ('kiritsugu', 1289), ('kirei', 9
82), ('time', 944), ('like', 929), ('rider', 753), ('waver', 738), ('irisvie
l', 729), ('servant', 675), ('master', 662), ('hand', 589), ('grail', 573),
('king', 526), ('right', 518), ('tokiomi', 485), ('lancer', 480), ('man', 47
7), ('eye', 477)]
```

Well... it seems to be the case when there is no winner. Not in the best way. First attempt makes no mistakes(but there will be mistakes, of course, if I take more than 20 top words), but it seems that many occurences were missed due to incorrect tagging. Second attempt got more occurances, but there are some mistakes - like adjectives. NLTK is somewhere in between - more captured occurences and more wrong words.

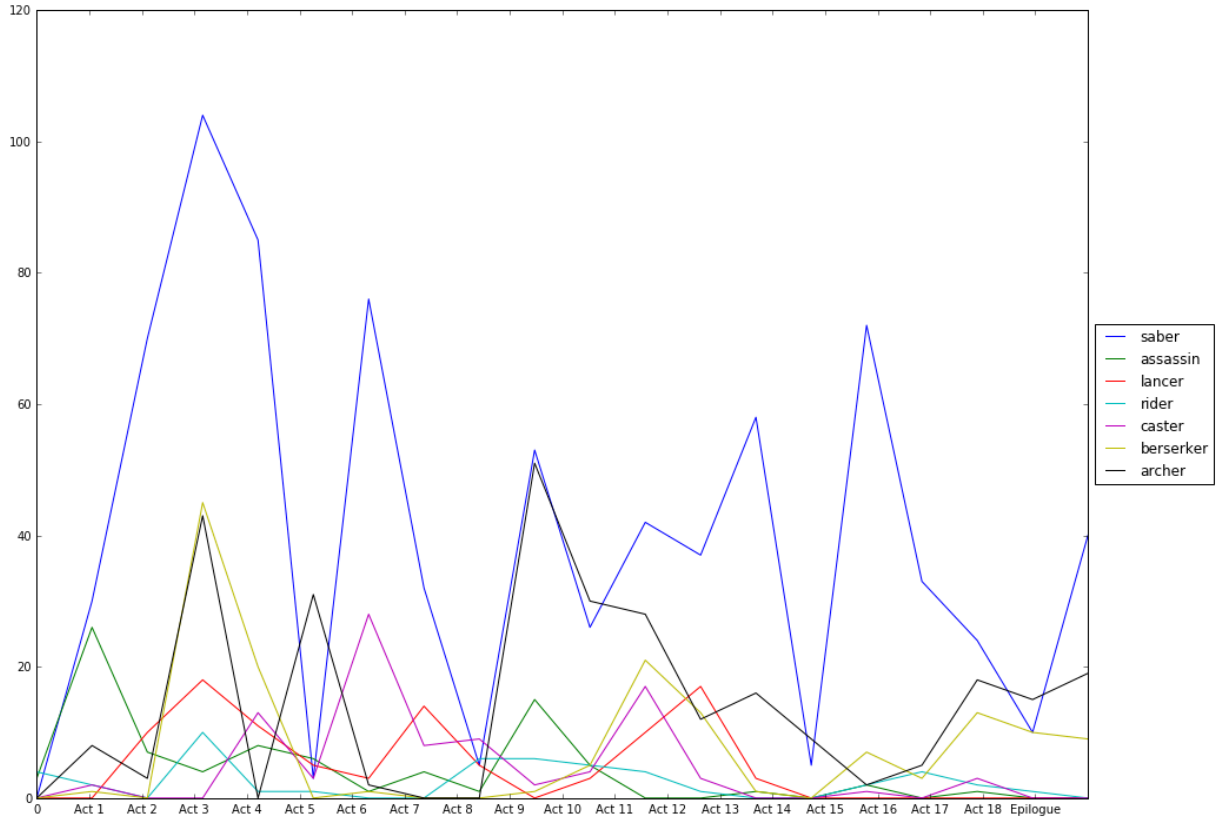
NLP has a long way to go :)

Now I'll use the first attempt to visualize the frequency of characters' mentions.

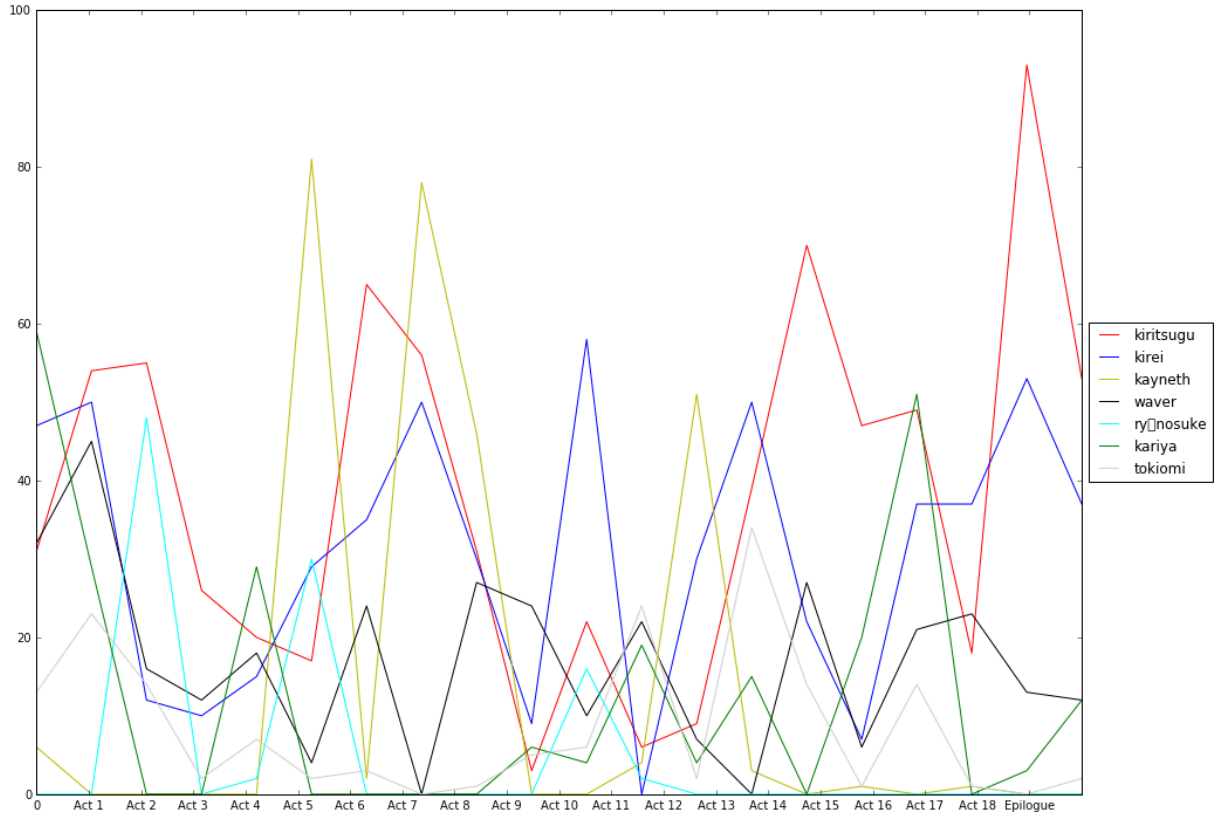
In [11]:
```python
def offsets(text):
    '''
    Collect positions of words in text.
    '''
    offsets = defaultdict(list)
    for ent in text.ents:
        if ent.label_ == 'PERSON':
            offsets[ent.lemma_].append(ent.start)

    return dict(offsets)

occurences = offsets(nlp_text)

def plot_character(labels):
    x = [occurences[label] for label in labels]
```

```
    plt.figure(figsize=(16,12))
    bins_n = 20
    n, bins, patches = plt.hist(x, bins_n, label=labels)
    plt.clf()
    ax = plt.subplot(111)
    for i, a in enumerate(n):
        ax.plot([float(x) / (bins_n - 1) for x in range(len(a))], a, label=l

    matplotlib.rcParams['axes.prop_cycle'] = cycler(color=['r', 'b', 'y', 'b
    ax.legend(loc='center left', bbox_to_anchor=(1, 0.5))
    #Divide plot into chapters. It isn't exact, but should be accurate enoug
    labels = [0, 0, 'Act 1', 'Act 2', 'Act 3', 'Act 4', 'Act 5', 'Act 6', 'A
              'Act 12', 'Act 13', 'Act 14', 'Act 15', 'Act 16', 'Act 17', 'A
    ax.set_xticklabels(labels)
    tick_spacing = 0.05
    ax.xaxis.set_major_locator(ticker.MultipleLocator(tick_spacing))
```

In [12]:
```
#Occurences of servants.
plot_character(['saber', 'assassin', 'lancer', 'rider', 'caster', 'berserker
```



In [13]:
```
#Occurences of masters.
plot_character(['kiritsugu', 'kirei', 'kayneth', 'waver', 'ryūnosuke', 'kari
```

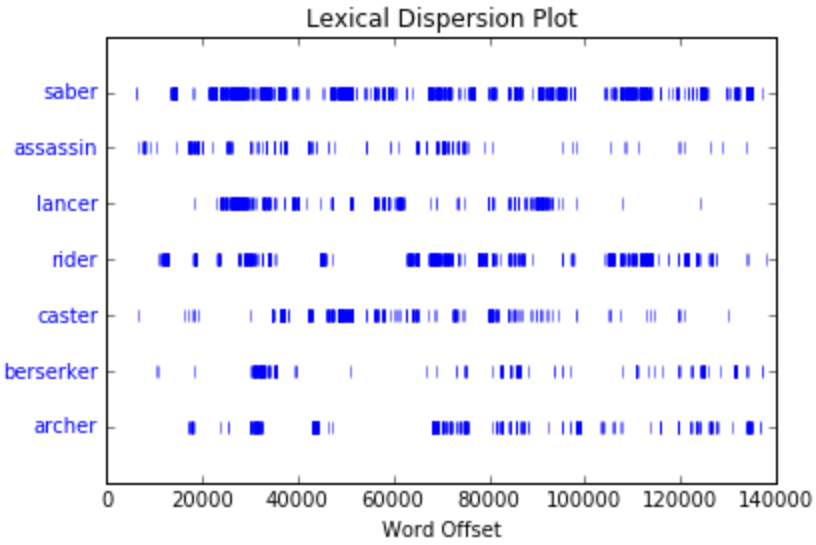


These plots show how often the characters were mentioned in the story. They could be improved, of course: characters could be adressed in a variety of ways, so a good idea would be to find all the ways the characters were adressed, group them and plot.

But nevertheless this plot shows general information: most active characters, parts of the story in which certain characters were most active and, of course, characters who died at some point and stopped being mentioned.

NLTK offers a possibility to draw a dispersion plot for chosen tokens, but it is very basic.

In [14]:
```
text_nltk.dispersion_plot(['saber', 'assassin', 'lancer', 'rider', 'caster',
```



More information about characters

It is possible to parse text and find relationships between words. For example, one could find adjectives, describing certain character.

In [15]:
```
def get_adjectives(doc, character_lemma):
    adjectives = []
    for ent in nlp_text.ents:
        if ent.lemma_ == character_lemma:
            for token in ent.subtree:
                if token.dep_ == 'amod':
                    adjectives.append(token.lemma_)

    for ent in nlp_text.ents:
        if ent.lemma_ == character_lemma:
            if ent.root.dep_ == 'nsubj':
                for child in ent.root.head.children:
                    if child.dep_ == 'acomp':
                        adjectives.append(child.lemma_)

    return adjectives
```

With this we can know general characterictics of the character. It is possible to extract adjectives for a character in each chapter/volume to see whether the characters mood changed in the story.

In [16]:
```
print(get_adjectives(nlp_text, 'waver'))
```

```
['good', 'defiant', 'puzzled', 'stern', 'mediocre', 'calm', 'rightful', 'wav
er', 'bloodthirsty', 'small', 'last', 'tense', 'interested', 'cautious', 'ex
alted', 'short', 'relieved', 'dizzy', 'convinced', 'pissed', 'aware', 'agita
ted', 'able', 'capable', 'superior', 'grateful', 'helpless', 'silent', 'unha
ppy', 'astonished', 'glad', 'different', 'uncomfortable', 'unused', 'eager',
'reluctant', 'worried', 'nauseous', 'mature', 'aware', 'oblivious', 'happy',
'alone', 'alone', 'able']
```

We can also find most used words belonging to separate parts of speach.

In [17]:
```
tag_list = ['PROPN', 'ADJ', 'ADP', 'PRON', 'ADV', 'NOUN', 'VERB']
for i in tag_list:
    words = [token.lemma_ for token in nlp_text if token.pos_ == i and toker
    words_count = Counter(words)
    print(i, words_count.most_common(10))
```

```
PROPN [('saber', 1373), ('kiritsugu', 1276), ('’s', 1222), ('kirei', 976),
('irisviel', 721), ('waver', 658), ('grail', 553), ('tokiomi', 480), ('maste
r', 447), ('lancer', 444)]
ADJ [('’s', 343), ('right', 268), ('great', 207), ('able', 204), ('black', 1
89), ('true', 189), ('long', 157), ('old', 156), ('different', 149), ('goo
d', 131)]
ADP [('like', 839), ('inside', 63), ('outside', 60), ('despite', 54), ('til
l', 38), ('beneath', 33), ('near', 27), ('past', 23), ('whilst', 20), ('unli
ke', 14)]
PRON [('you’re', 23), ('’s', 20), ("'s", 17), ('you…', 13), ('i’ll', 10),
('i’ve', 7), ('—', 5), ('you’ve', 5), ('oneself', 5), ('you’ll', 5)]
ADV [('completely', 277), ('away', 227), ('definitely', 217), ('matter', 19
9), ('finally', 197), ('suddenly', 186), ('right', 178), ('long', 162), ('fa
r', 156), ('probably', 152)]
NOUN [('time', 915), ('hand', 574), ('man', 526), ('eye', 471), ('battle', 4
59), ('body', 413), ('heart', 407), ('thing', 393), ('word', 338), ('world',
336)]
VERB [('know', 514), ('use', 501), ('feel', 489), ('look', 485), ('think', 4
52), ("'", 450), ('come', 402), ('want', 378), ('leave', 341), ('understan
d', 340)]
```

One more interesting idea is to find characters, who are described by the same thing. This could be an adjective, verb, or something else.

In [18]:
```
counter = Counter()
word_list = ['say', 'tell', 'speak']

for ent in nlp_text.ents:
    if ent.label_ == 'PERSON' and ent.root.head.lemma_ in word_list:
        counter[ent.text] += 1

print(counter.most_common(30))
```

```
[('Kirei', 17), ('Saber', 16), ('Tokiomi', 9), ('Irisviel', 9), ('Waver',
8), ('Archer', 8), ('Kiritsugu', 8), ('Kayneth', 7), ('Maiya', 5), ('Shirle
y', 4), ('Rin', 2), ('Glen', 2), ('Kotomine Kirei', 2), ('Bluebeard', 2),
('Ryūnosuke', 2), ('Natalia', 2), ('Sola', 2), ('we’ve', 1), ('Gilgamesh',
1), ('Hisau Maiya… Irisviel', 1), ('Mother', 1), ('Emiya Kiritsugu', 1), ('L
ancer', 1), ('Zōken', 1), ('Sabbāh', 1), ('Natalie', 1), ('Ilya', 1), ('Iris
viel von Einsbern', 1), ('Grandfather', 1), ('Alexander', 1)]
```

It could seem that characters don't speak a lot. But this is due to the nature of the text - words, describing an action of saying something, are seldom used.

Common collocations

One of the ways to find out an unique style of the text is looking for collocatins. I divide the text into phrases of two or more words to see which of the most common ones are unique to this text.

In [19]:
```
n_grams = ngrams(text_tokens,2)
Counter(n_grams).most_common(20)
```

Out[19]:
```
[(('saber', 's'), 312),
 (('holy', 'grail'), 307),
 (('heroic', 'spirit'), 281),
 (('kiritsugu', 's'), 250),
 (('noble', 'phantasm'), 232),
 (('emiya', 'kiritsugu'), 193),
 (('couldn', 't'), 190),
 (('command', 'seal'), 189),
 (('kirei', 's'), 175),
 (('wasn', 't'), 167),
 (('rider', 's'), 165),
 (('heaven', 's'), 153),
 (('isn', 't'), 152),
 (('s', 'feel'), 150),
 (('kotomine', 'kirei'), 148),
 (('waver', 's'), 123),
 (('king', 'conqueror'), 123),
 (('lancer', 's'), 120),
 (('irisviel', 's'), 115),
 (('tokiomi', 's'), 112)]
```

Common phrases include character names or termins from the story.

In [20]:
```
n_grams = ngrams(text_tokens,3)
Counter(n_grams).most_common(20)
```

Out[20]:
```
[(('heaven', 's', 'feel'), 150),
 (('holy', 'grail', 'war'), 40),
 (('couldn', 't', 'help'), 40),
 (('lord', 'el', 'melloi'), 39),
 (('s', 'noble', 'phantasm'), 36),
 (('war', 'holy', 'grail'), 36),
 (('kotomine', 'kirei', 's'), 29),
 (('emiya', 'kiritsugu', 's'), 28),
 (('lancer', 's', 'master'), 25),
 (('long', 'time', 'ago'), 22),
 (('tōsaka', 'tokiomi', 's'), 20),
 (('kayneth', 'el', 'melloi'), 17),
 (('s', 'right', 'hand'), 17),
 (('waver', 'couldn', 't'), 15),
 (('el', 'melloi', 's'), 14),
 (('use', 'command', 'seal'), 13),
 (('saber', 's', 'master'), 13),
 (('t', 'help', 'feel'), 13),
 (('kariya', 's', 'body'), 13),
 (('fourth', 'heaven', 's'), 13)]
```

In [21]:
```
n_grams = ngrams(text_tokens,4)
Counter(n_grams).most_common(20)
```

Out[21]:
```
[(('couldn', 't', 'help', 'feel'), 13),
 (('fourth', 'heaven', 's', 'feel'), 13),
 (('lord', 'el', 'melloi', 's'), 10),
 (('kayneth', 'el', 'melloi', 'archibald'), 9),
 (('saber', 's', 'noble', 'phantasm'), 9),
 (('saber', 's', 'left', 'hand'), 9),
 (('anti', 'fortress', 'noble', 'phantasm'), 9),
 (('sola', 'ui', 'nuada', 'sophia'), 7),
 (('ui', 'nuada', 'sophia', 'ri'), 7),
 (('command', 'seal', 'right', 'hand'), 6),
 (('rider', 's', 'noble', 'phantasm'), 6),
 (('participating', 'heaven', 's', 'feel'), 6),
 (('waver', 'couldn', 't', 'help'), 5),
 (('short', 'spear', 'left', 'hand'), 5),
 (('archer', 's', 'noble', 'phantasm'), 5),
 (('kiritsugu', 's', 'right', 'hand'), 5),
 (('irisviel', 'couldn', 't', 'help'), 5),
 (('previous', 'heaven', 's', 'feel'), 4),
 (('lancer', 's', 'red', 'spear'), 4),
 (('bastard', 'bastard', 'bastard', 'bastard'), 4)]
```

But the more words are in the phrase, the more probable it is that is was a coincidence. Bi- and trigrams are usually the most interesting.

Wordcloud

Wordclouds provide a great way of showing topics or most important words in the text.

In [22]:
```
#The source of the icon: http://icons.iconarchive.com/icons/icons8/windows-8
mask_ = imread('Data various/Fate_Zero/sword.png', flatten=False)
wordcloud = WordCloud(max_font_size=None, mask=mask_, stopwords=en_stop, bac
                      width=1200, height=1000).generate(text)
plt.figure(figsize=(12,8))
plt.imshow(wordcloud)
plt.axis("off")
plt.show()
```

Conclusion

In this notebook I showed some of the ways to extract information from texts. NLP and machine learning allow ot get a gist of a story, to describe the events and many other things. A more advanced idea is to automatically summarize texts, but this will be adressed in another notebook.