

# Shakespeare versus AI

Spot the differences using SAS<sup>®</sup> Visual Text Analytics

MARY OSBORNE

SAS PRODUCT MANAGER, NATURAL LANGUAGE PROCESSING

# It is a kind of history...



- William Shakespeare wrote over 30 plays, 2 long narrative poems, and 154 sonnets.
- He made many contributions to the English language that have persisted into modern times.
  - Both with phrases
  - And with words

# Love all, trust a few, do wrong to none.

The plan...

- Use OpenAI's ChatGPT, Meta's Llama2, and Google's Bard to generate Shakespearean-style tragedies in iambic pentameter with themes similar to Macbeth.
- Take subjective observational notes.
- Use SAS<sup>®</sup> Visual Text Analytics to dig a little deeper objectively.

# Things won are done; joy's soul lies in the doing.

The prompt:

Using Shakespeare's tragedy Macbeth as inspiration, create a five-act tragedy with multiple scenes in each act. The dialogue between characters should be in iambic pentameter. It should have at least 6 characters with at least one royal person. The setting should be medieval Scandinavia and involve Vikings.

# ChatGPT character breakdown

ChatGPT named the tragedy (without being prompted to) Ragnarok's Lament, a saga of treachery, redemption, and the indomitable spirit of the Viking people.

- King Haldor
- Sigrid, Haldor's daughter
- Torin, a brave Viking warrior
- Freya, a seer
- Bjorn, a bad guy who wants to steal the throne



# ChatGPT Basic Storyline and Observations

- ChatGPT created the most robust story from the original prompt.
- It had elements similar to Macbeth.
- It was able to keep the dialogue in iambic pentameter.
- ChatGPT originally ended the tragedy with a happy ending.

# Llama2 Character Breakdown

Llama 2 didn't give a flowery overview or title of its Viking saga.

- King Harald, a middle-aged Viking king
- Prince Olaf, King Harald's son
- Prince Sigurd, King Harald's son
- Friga, a witch
- Jarl Erik, a friend and advisor of Olaf
- Archbishop of Canterbury, officiates the coronation of Prince Olaf to king



# Llama2 Basic Storyline and Observations

- Llama2 fell in and out of iambic pentameter.
- It also had elements similar to Macbeth.
- The story started falling apart around Act III.
- The familial relationships between characters went awry in Act IV.
- Act V was an unrelated mess, but not a tragic ending.



# Bard Character Breakdown

Bard also didn't give a flowery overview or title of its tragedy.

- King Harald, the king of Norway
- Queen Astrid, the queen of Norway
- Prince Bjorn, heir to the throne of Norway
- Princess Ingrid, Prince Bjorn's younger sister
- Count Erik, a powerful advisor to the king
- Lady Freya, a beautiful woman favored by the king
- The Witch, a powerful sorceress
- Igor, leader of the Rus



# Bard Basic Storyline and Observations

- Bard started in iambic pentameter, but quickly fell out.
- The story had a supernatural element with a witch, but no other Macbeth like connections.
- The dialogue generated was incredibly simple and degraded as the story went on.
- Bard had the King marry Freya (when the original Queen was still around) and the King announcing that he was pregnant....

# Dialogue from Bard

King Harald:

(to his family)

I have called you here today to announce some important news.

Queen Astrid:

What is it, my dear?

King Harald:

I have decided to marry Lady Freya.

Prince Bjorn:

What?

Princess Ingrid:

But Father, you cannot!

King Harald:

I can and I will.

Lady Freya is a beautiful and intelligent woman, and she will make a wonderful queen.

Prince Bjorn:

But she is not of royal blood!

King Harald:

(to his family)

I have called you here today to announce some important news.

Queen Astrid:

What is it, my dear?

King Harald:

I am pregnant.

Prince Bjorn:

What?

Princess Ingrid:

But Father, you are too old to have a child.

King Harald:

I know, but it is true.

Lady Freya is carrying my child.

Prince Bjorn:

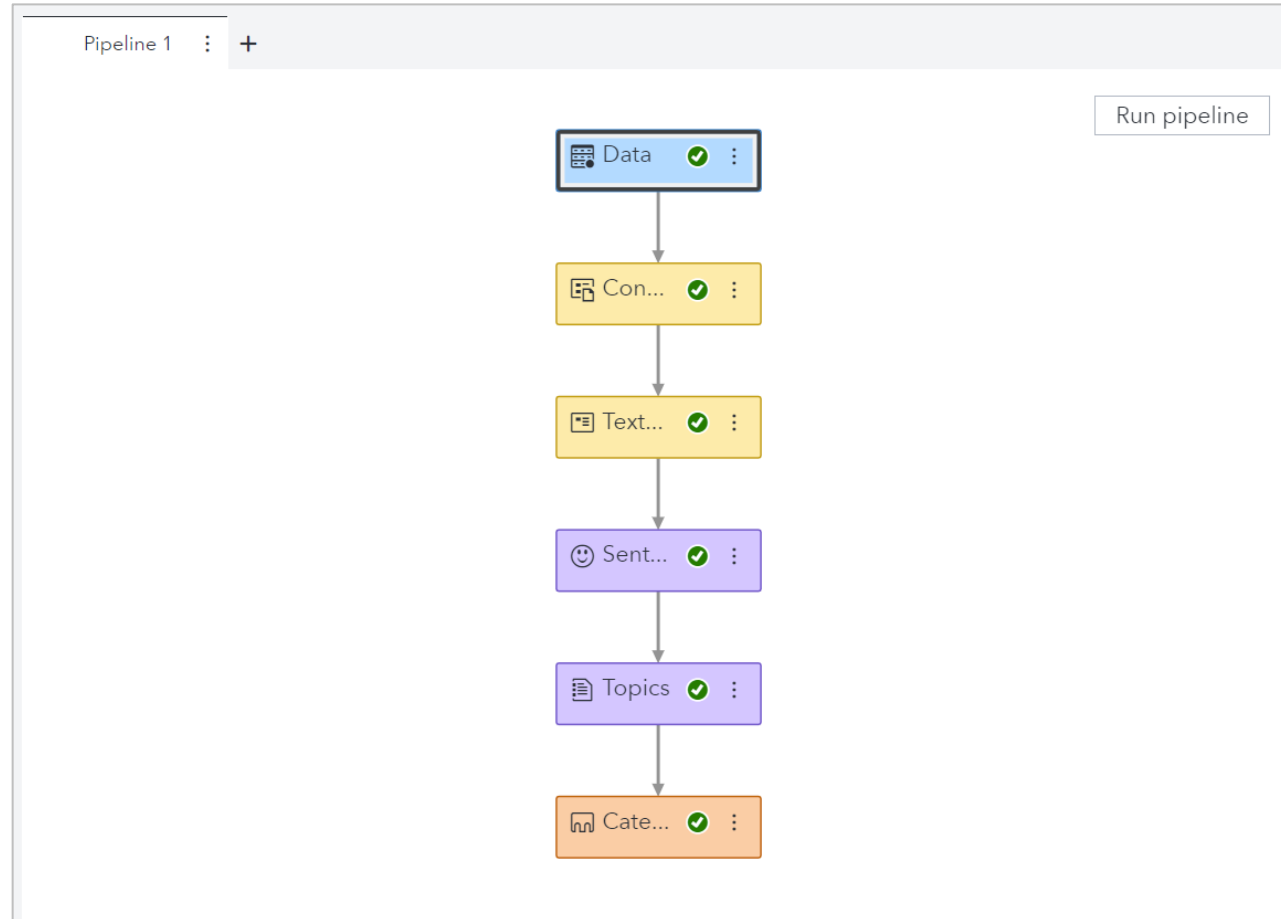
This is madness!

Beginning of Act IV

Beginning of Act V

# Analyzing LLM output using NLP

Using SAS® Visual Text Analytics to explore the data objectively



# Top terms in Macbeth

SAS® Visual Text Analytics terms listing

	Term	↑	Role	Documents	Frequency ↓	
<input type="checkbox"/>	not		ADV	163	165	
<input type="checkbox"/>	▸ come		V	74	78	
<input type="checkbox"/>	macbeth		PN	69	75	
<input type="checkbox"/>	enter		V	72	72	
<input type="checkbox"/>	thee		N	60	61	
<input type="checkbox"/>	▸ make		V	59	60	
<input type="checkbox"/>	now		ADV	53	53	
<input type="checkbox"/>	▸ man		N	51	51	
<input type="checkbox"/>	▸ know		V	47	48	

# Top terms in the generated tragedies

SAS® Visual Text Analytics terms listing

Term	↑	Role	Documents	Frequency ↓
torin		PN	55	55
sigrid		PN		
haldor		PN		
bjorn		PN		
king		N		
▶ heart		N		
treasure		N		
darkness		N		
cursed		A		

ChatGPT

Term	↑	Role	Documents	Frequency ↓
<input type="checkbox"/> erik		PN	30	35
<input type="checkbox"/> not		ADV		
<input type="checkbox"/> king		N		
<input type="checkbox"/> sigurd		PN		
<input type="checkbox"/> thee		N		
<input type="checkbox"/> kingdom		N		
<input type="checkbox"/> sigrid		PN		
<input type="checkbox"/> olaf		PN		
<input type="checkbox"/> throne		N		

Llama2

Term	↑	Role	Documents	Frequency ↓
<input type="checkbox"/> rus		PN	24	24
<input type="checkbox"/> know		V	22	22
<input type="checkbox"/> not		ADV	21	21
<input type="checkbox"/> freya		PN	18	18
<input type="checkbox"/> king		N	15	15
<input type="checkbox"/> harald		PN	14	14
<input type="checkbox"/> norway		nlpPlace	13	13
<input type="checkbox"/> ▶ defeat		V	10	11
<input type="checkbox"/> lady		A	11	11

Bard

# Top topics in Macbeth

## SAS® Visual Text Analytics topics listing

<input type="checkbox"/>	Topic	Created by	Docum... ↓
<input type="checkbox"/>	now, thee, +know, +time, th	System	169
<input type="checkbox"/>	not, +know, +speak, +let	System	163
<input type="checkbox"/>	macbeth, enter, banquo, lady, lady macbeth	System	119
<input type="checkbox"/>	+say, +time, th, +king, +ti	System	114
<input type="checkbox"/>	+come, here, +see, +know, +king	System	91
<input type="checkbox"/>	+make, now	System	59
<input type="checkbox"/>	+man, +good, thee, then, blood	System	58
<input type="checkbox"/>	macduff, lady, enter, _exit, +look	System	51
<input type="checkbox"/>	+murderer, first, second, third, enter	System	39
<input type="checkbox"/>	_exeunt, +alarum, +lord	System	30

# Top topics in the generated tragedies

## SAS® Visual Text Analytics topics listing

Topic	Created by	Documents ↓
torin, freya, +stand, sigrid, +sword	System	59
sigrid, +look	System	47
king, haldor, +look	System	44
+heart	System	41
bjorn, greed	System	39
darkness, light, +path	System	38
treasure, cursed treasure, cursed,	System	37
kingdom, freya, +spirit, +stand, lig	System	36

ChatGPT

Topic	Created by	Documents ↓
sigurd, olaf, king, prince, prince	System	24
curse, heart, +find, dragon, +power	System	20

Llama2

Bard

Topic	Created by	Documents
norway, never, freya, lady, queen	System	32
rus, +defeat, erik	System	24
not, let	System	21
freya, lady, +exit, father	System	21
harald, king, king, +raise, cup	System	19
know	System	18
majesty, spell	System	9



# Macbeth and early modern English pronouns

## SAS® Visual Text Analytics terms

Macbeth > Text Parsing - Manage Terms Run node Close

Kept Terms (475)  🔍 🔍 🔍 🔍 🔍

<input checked="" type="checkbox"/>	Term	Role	Documents	Frequency
<input checked="" type="checkbox"/>	thee	N	60	61
<input type="checkbox"/>	▶ make	V	59	60
<input type="checkbox"/>	now	ADV	53	53
<input type="checkbox"/>	▶ man	N	51	51
<input type="checkbox"/>	▶ know	V	47	48
<input type="checkbox"/>	macduff	PN	48	48

Dropped Terms (3476)  🔍 🔍 🔍 🔍 🔍

<input type="checkbox"/>	Term	Role	Documents	Frequency
<input type="checkbox"/>	you	PRO	190	205
<input type="checkbox"/>	▶ in	PPOS	178	184
<input type="checkbox"/>	my	DET	175	183
<input type="checkbox"/>	▶ do	V	171	177
<input type="checkbox"/>	▶ will	V	152	157
<input type="checkbox"/>	with	PPOS	153	157

Documents

All (2571) Matched (60 of 2571)  🔍 🔍 🔍 🔍 🔍

text	character_narration_description
...thy words become <b>thee</b> as thy wounds:	Duncan
... <b>thee</b> , witch! the rump-fed ronyon cries.	First Witch

# Macbeth and early modern English pronouns

## SAS® Visual Text Analytics document detail

Documents

All (2571) **Matched (25 of 2571)** Search

text	character_narration_description
<b>Thou</b> shalt get kings, though <b>thou</b> be none:	Third Witch
...of greatness) that <b>thou</b>	Lady Macbeth
... <b>thou</b> art, and Cawdor; and shalt be	Lady Macbeth
...which cries, Thus <b>thou</b> must do, if <b>thou</b> have it;	Lady Macbeth
...that which rather <b>thou</b> dost fear to do,	Lady Macbeth
... <b>thou</b> art in desire? Wouldst <b>thou</b> have that	Lady Macbeth
...the deed. Didst <b>thou</b> not hear a noise?	Macbeth

# GenAI and early modern English pronouns

## SAS® Visual Text Analytics document detail

Documents

All (153) **Matched (11 of 153)** Search

Text	Character...
...I know, that <b>thou</b> shalt always be, a true ally, and a loyal friend. Farewell, Sigrid, and may the gods, watch over thee, And guide thee, on thy journey, where'er thou mayst be.	Erik
...tell me all <b>thou</b> know'st, That I, thy son, may be prepared to face The trials that lie ahead, and conquer them.	Prince Einar
...escape This destiny: <b>thou</b> must find the sacred horn, That doth belong to Odin, king of gods, And use it to summon him, and beg his aid.	Sigrid
...threaten me. Sigrid, <b>thou</b> art wise, And knowest much of magic and of spells, Pray tell, how shall I find this sacred horn?	Erik
...Drink this, and <b>thou</b> shalt see the beast, In a different light, and thus <b>thou</b> shalt Be able to defeat it, and claim the horn.	Sigrid
... <b>thou</b> art brave and strong, and worthy of the throne. But listen well, for I have one more thing to say. The curse that doth threaten thee, it is not yet gone. For the dragon's fire, it did not burn thee, But it did leave a mark, a sign of the curse. Look at thy hand, and <b>thou</b> shalt see, A symbol of the curse, that doth still remain.	Sigrid

# What's in a name?

profileText sentence statistics

Corpus	Total Number of Sentences	Average Tokens per Sentence	Maximum Tokens per Sentence
Macbeth	3013	7.3	21
ChatGPT	486	9.4	25
Llama2	321	14.9	58
Bard	299	7.6	26

# The longest Llama2 sentence

Massive mid-story hallucination

My dearest Helga, wife of mine, and son,  
Einar, our heir, I call thee both to hear  
A prophecy of woe, that doth afflict  
Our royal line, and threatens to inflict  
A curse upon our house, a plague so dire  
That all our reign, and all our royal fire  
Shall be reduced to naught but ash and smoke.

# That which we call a rose, profileText token statistics

Corpus	Total Tokens	Total Unique Tokens	Number of Unique Tokens Comprising 80% of Data	Total Tokens
Macbeth	22063	3273	442	22063
ChatGPT	4570	1013	270	4570
Llama2	4794	830	203	4794
Bard	2283	411	101	2283

# By any other word

profileText token statistics

Corpus	Average Token Length	Maximum Token Length
Macbeth	3.5	19
ChatGPT	4.0	14
Llama2	3.7	16
Bard	3.4	13

# Would smell as sweet

profileText token composition statistics

Corpus	Percentage of Content Tokens	Percentage of Stop Tokens	Percentage of Punctuation Tokens
Macbeth	37%	43%	20%
ChatGPT	48%	36%	17%
Llama2	40%	44%	16%
Bard	35%	48%	17%



# Zipf's law - Macbeth

profileText token composition detail

	⚡#_FORM_	⊕#_FREQUENCY_ ↓	⚡#_TYPE_
1	,	1692	punct
2	.	1140	punct
3	the	659	stop
4	and	567	stop
5	to	375	stop
6	i	368	stop
7	of	338	stop
8	;	289	punct
9	?	239	punct
10	that	238	stop
11	'd	237	stop
12	a	236	stop

# Zipf's law – AI generated tragedies

## profileText token composition detail

		ChatGPT		Llama2		Bard	
	⚙️ _FORM_	⊕ _FREQUENCY_ ↓	⚙️ _TYPE_		⊕ _FREQUENCY_ ↓	⚙️ _TYPE_	
1	,	520	punct				
2	the						
3	.	1	,		441	punct	
4	and	2	.				
5	to	3	the	1	.	244	punct
6	a	4	and	2	,	102	punct
7	's	5	to	3	i	102	stop
8	of	6	i	4	the	75	stop
9	our	7	a	5	you	67	stop
10	with	8	of	6	is	64	stop
11	torin	9	my	7	will	63	stop
12	king	10	is	8	to	55	stop
		11	that	9	and	53	stop
		12	with	10	a	39	stop
				11	!	36	punct
				12	this	30	stop

# All's well that ends well...or is it?

## A few parting thoughts

- Generative AI is incredibly cool.
- Prompts matter.
- ChatGPT, Llama2, and Bard aren't Shakespeare.
- Linguistically solid doesn't make for solid content.
- NLP techniques can be used to better understand content generated by LLMs.

# To be or not to be? That is the question.

Speaking of, does anyone have any?



And whether we shall meet again I know not.

Therefore our everlasting farewell take:

For ever, and for ever, farewell, [SAS Explorers]!

If we do meet again, why, we shall smile;

If not, why then, this parting was well made.