GPT
Pretraining Stage Implementation

Sparsh Celly

Problem Statement

To create a generalized Large Language Model which generates text resembling the syntactic and semantic pattern of the text corpus it is trained on

```
ROMEO:
And we mean well in going to this mask;
But 'tis no wit to go.

MERCUTIO:
Why, may one ask?

ROMEO:
I dream'd a dream to-night.
```

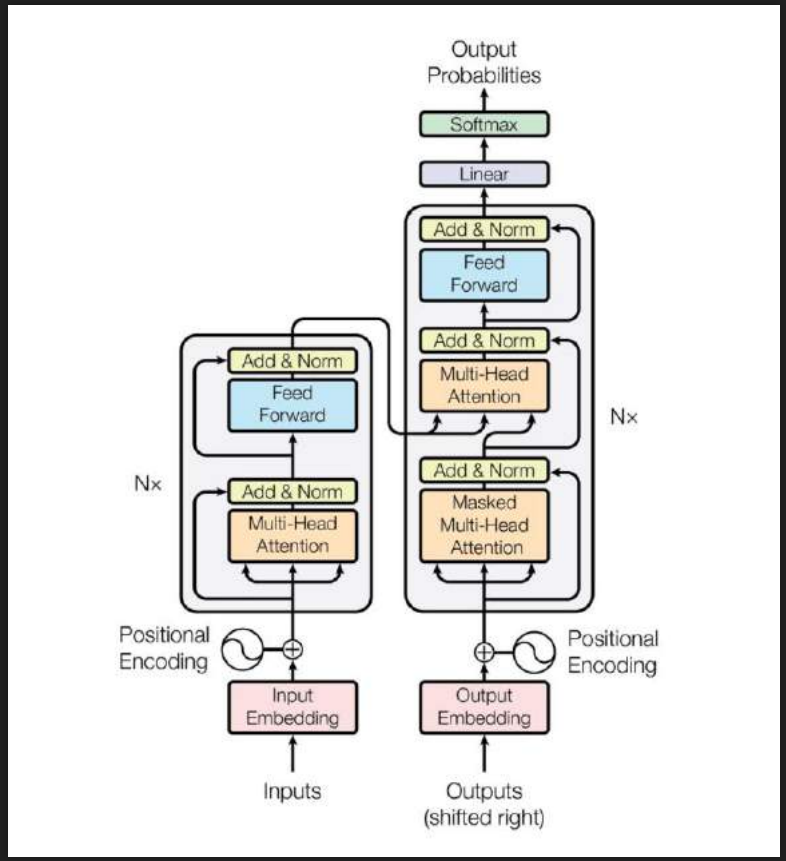
Existing text

```
Roman:
O, I come! wherefore us this comfort is curse.

MERCUTIO:
And if the be brief, so consult, on Thursday next.

Nurse:
Nay, gentlemen,
I am content: here again; it is a gain fawrd.
```

New unique text

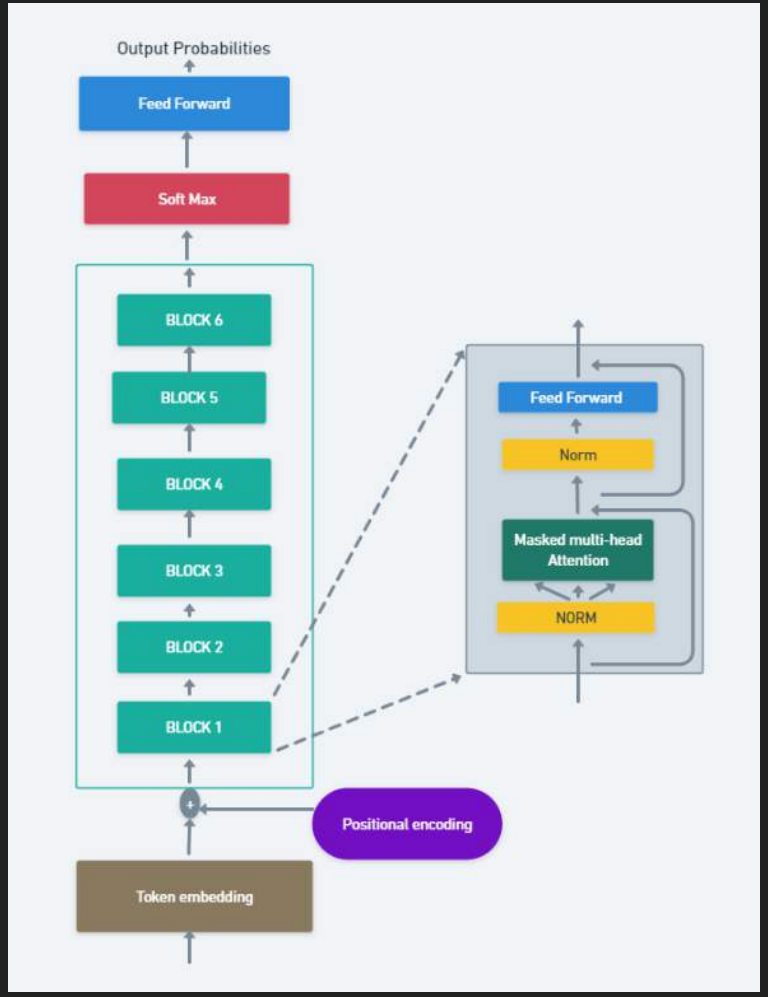
OpenAI's GPT Architecture

- Used for sequence to sequence translation/analysis
- Encoder + Decoder architecture
- Cross Attention + Self Attention



Our GPT Architecture

- 6 layer deep ***Decoder only*** architecture
- ***Self-Attention***
- ***Res-Net*** (CNN)
- ***Initialized weights*** within a standard deviation (BERT)
- Used ***PreNorm*** (Llama)
- Introduced ***Dropout*** to tackle overfitting



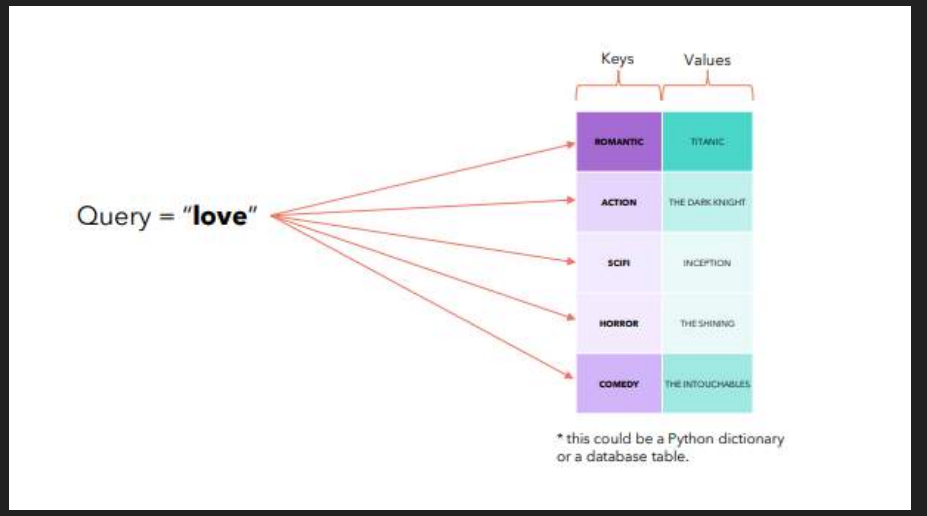
Working

Token + Positional Embedding

Working

	YOUR	CAT	IS	A	LOVELY	CAT
YOUR	0.268	0.119	0.134	0.148	0.179	0.152
CAT	0.124	0.278	0.201	0.128	0.154	0.115
IS	0.147	0.132	0.262	0.097	0.218	0.145
A	0.210	0.128	0.206	0.212	0.119	0.125
LOVELY	0.146	0.158	0.152	0.143	0.227	0.174
CAT	0.195	0.114	0.203	0.103	0.157	0.229

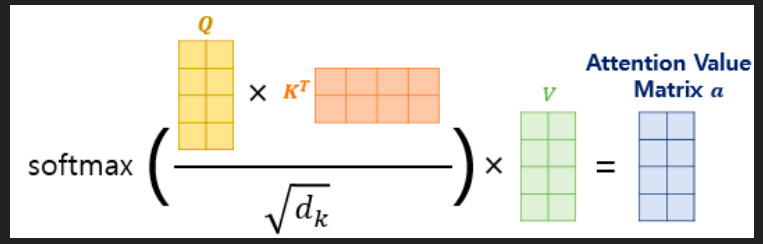
Initial random embedding table

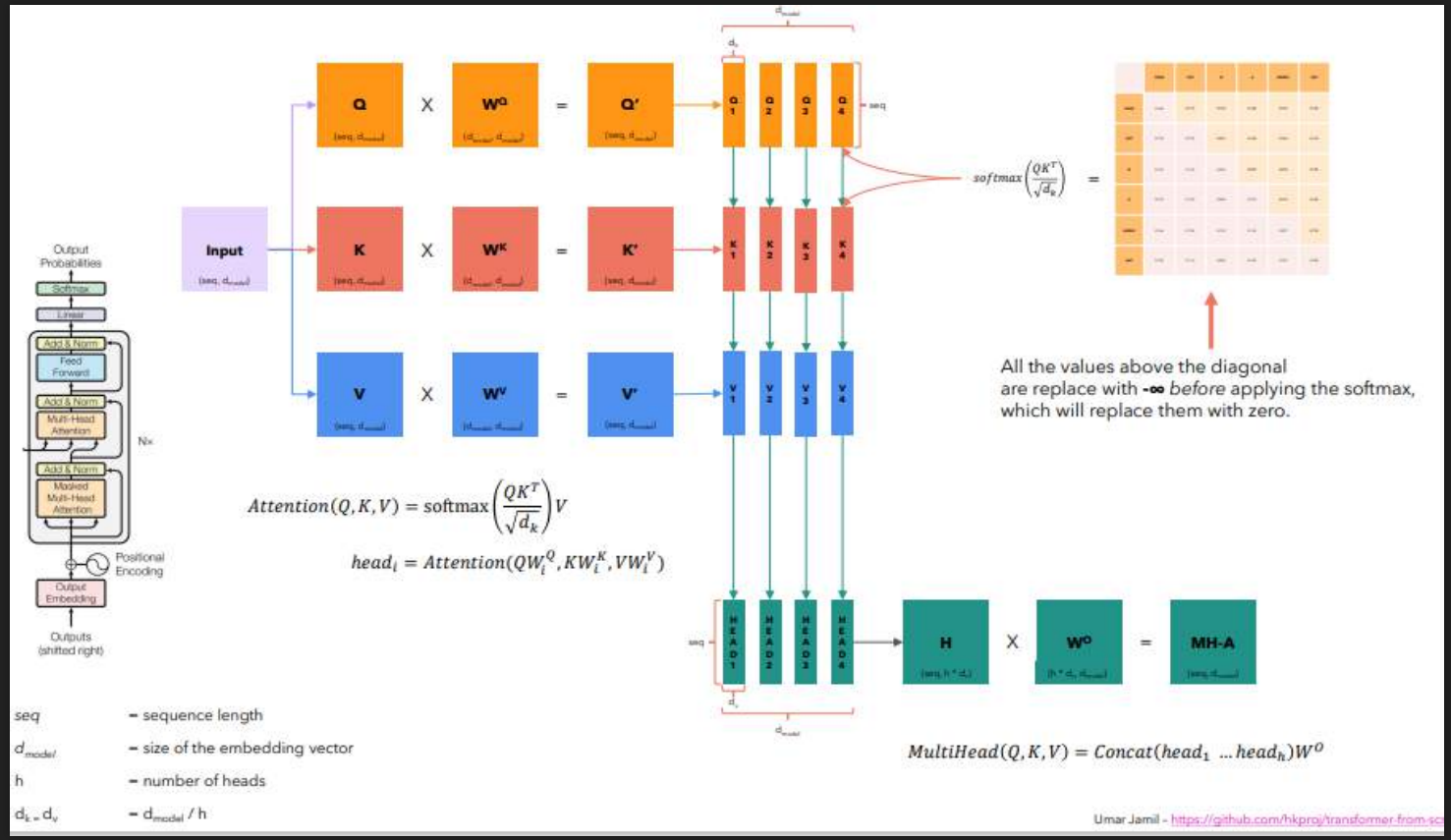


Intuition of Q,K,V matrices

Working

Muti-Head Attention

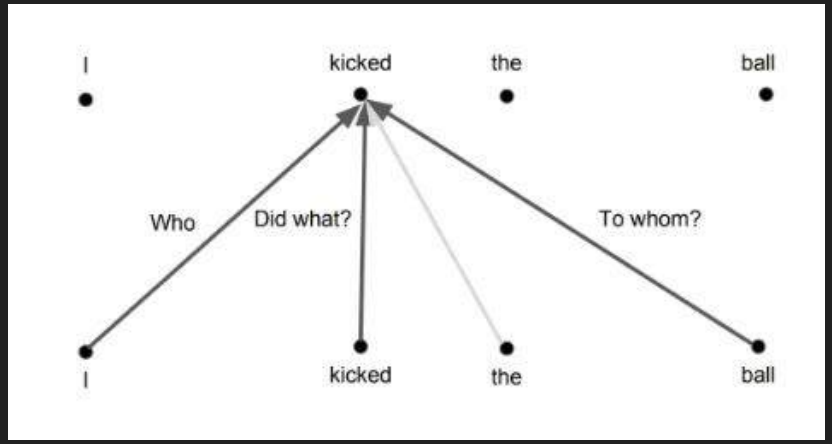




Working

	YOUR	CAT	IS	A	LOVELY	CAT
YOUR	0.268	0.119	0.134	0.148	0.179	0.152
CAT	0.124	0.278	0.201	0.128	0.154	0.115
IS	0.147	0.132	0.262	0.097	0.218	0.145
A	0.210	0.128	0.206	0.212	0.119	0.125
LOVELY	0.146	0.158	0.152	0.143	0.227	0.174
CAT	0.195	0.114	0.203	0.103	0.157	0.229

What Logits table represents



Final Logits table ready → Passed into generator function to generate text

Attempts

1. Basic Bi-Gram model

50,000 epochs
Loss: **2.530**

```
AUShind helencowisce scatrgo bul bllerjute's Louda fey outhe; y atw keath,
Aw
Solye Mar why


SSovecots meand
Jot f II'd heper:
Go osoure bt tir;
Thou momy o pathtrevers y sw the nsto othe bl bred,

imy,
Aseso cehestilaladin thonth therdithis he fras peanoung t, ver
ENouied ptoutounenoucke s!
I f mym, tint.'s y CLoned irinsthay, hest, r s EENCEd d.
TRDu wis atlor e my y s bomy ure belds f ICHELOR: an y s t ouind
YCEDI ico le t
I Me ho thet l RDienoue RLIO, sos wiline IClonelat hos sam,
ADWiry, k
```

Attempts

2. Self-Attention GPT Model

0.20 M parameters
5000 epochs
Loss: **1.8239**

```
step 4700: train loss 1.6786, val loss 1.8348
step 4800: train loss 1.6659, val loss 1.8445
step 4900: train loss 1.6711, val loss 1.8384
step 4999: train loss 1.6630, val loss 1.8230

ROMEO:
But you far you
my swap with thus; come hath I uD
If sleemition of where's granded
Of their of tout the gortune upwon alond, liege man to is Iell this surpe
And than sleue thus mind, his by blow,
Virdty toward butied, Ditire spresiss with thou some not.

LORIO:
I am part
But thou sging them but
shat secondes morry thou sovore.

ISABUS:
What art sade but hither, thange e'en,
Protes as kingle me; an your tords whom are Ineal.

MENENIUS:
```

Attempts

3. Using OpenAI's Tiktoken tokeniser

6.68 M parameters
6000 epochs
Loss : **4.811**

```
step 5800: train loss 4.0292, val loss 4.8398
step 5999: train loss 3.9967, val loss 4.8119
! God B access 'twere tender?

RICHARD:
Welcome grandards stand of those satisfy!

Nay, wretchedokes-day; my name at this!
Pers's Marcius's fair life!
I was firm the poor word, to make a town,
To lord; jealous with dis OF YORK: yet unscISABETH:
I shall be too it you.
Thou art a ball queen hath measure of this fair with words long ensixest,
ityeduc his mother's be weeps; or else, to each reserved:
To do rise to set a week the younger then
But he, you to that the stones. Therefore spleen have

When in heart was the other Wen and the ocean.
COMINIUS:
The he will not corruptius.


FLORIZELBRAKENBURY:
To and the drunk
Do not with him;
My lord madINCE ED own blood dead.
The crown spirit that he may I disdain'er as you
```

Attempts

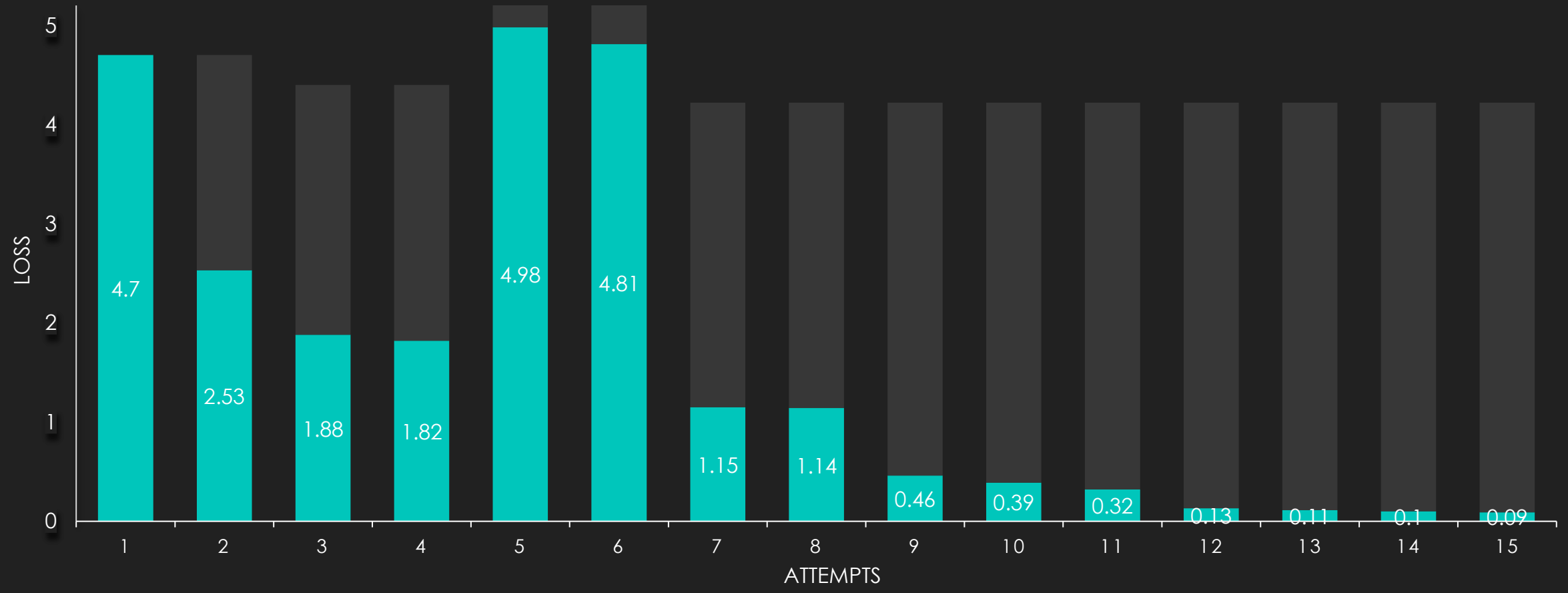
4. Final model

(GPT + Res-Net + Init_wts + Prenorm + Dropout)

10.788 M parameters
17500 epochs
Loss: **0.0974**

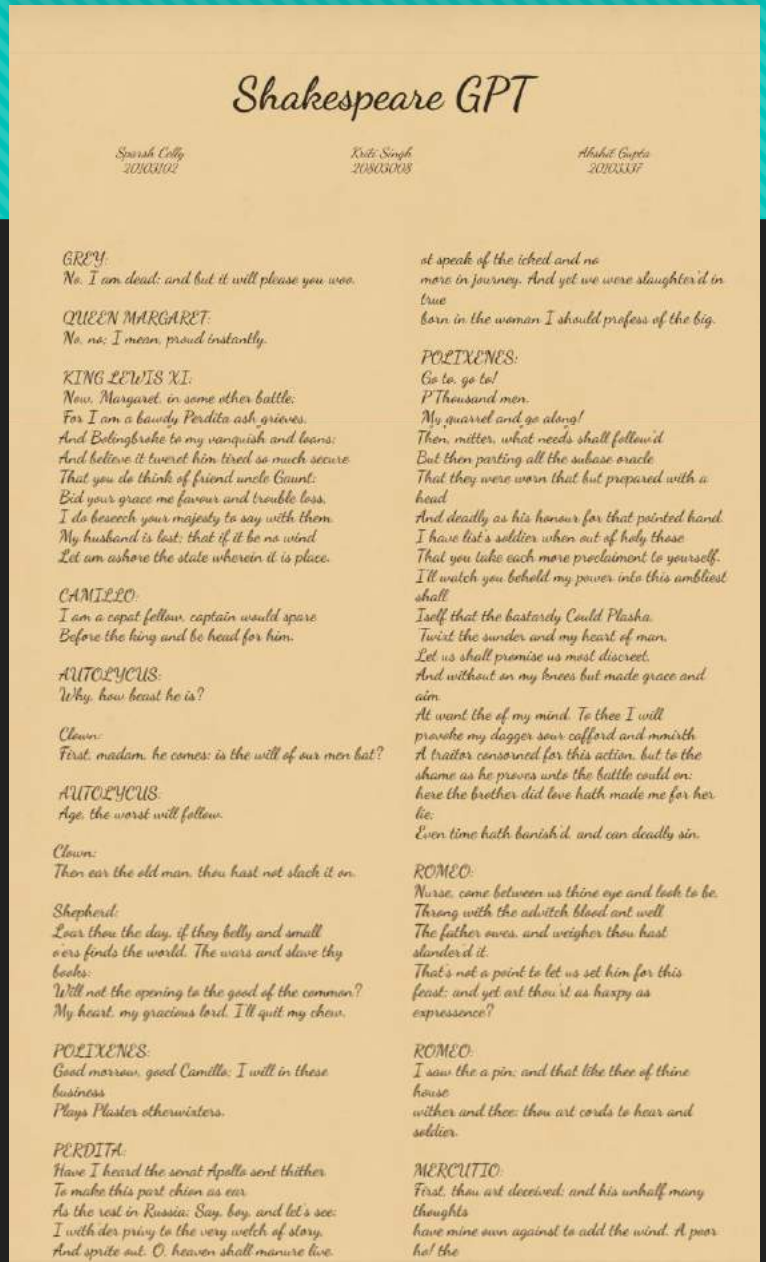
```
NORTEGOLIO:
We will see to-morrow.

LUCIO:
This may past for them.

ESCALUS:
Say you lie that 'twere one that Tunis.

ELBOW:
Come your ways, sir; come.

POMPEY:
You will not bail me, then, she will be true.

LUCIO:
She's in the right.

ISABELLA:
That's Accuses, by Sigeia tellus; for we'll
I lean to hear ye the skyey curb, being the
preserved bookic of any ill-beehal'd,
And now by the rebels where he have was letter the
horse of the secrets, it was more sure in the
time, they did love the thresheses of the person, he
with the men out thet to be three at the earth-to
of our over-rough; whose honour and how see
you so oftend home?
```

Loss Progress over Attempts



Future Prospects

- Rhymes / Couplets / Scripts / Poems generation
- Musical melodies generation
- Recreate Old English / Languages
- Implement Fine-tuning stage to answer prompts



Shakespeare GPT

Sparsh Colly
20103102

Kriti Singh
20803008

Akshit Gupta
20103337

GREY:
No. I am dead: and but it will please you woo.

QUEEN MARGARET:
No, no; I mean, proud instantly.

KING LEWIS XI:
Now, Margaret, in some other battle:
For I am a bawdy Perdita ash grieves.
And Bolingbroke to my vanquish and loans:
And believe it tweret him tired so much secure
That you do think of friend uncle Count:
Bid your grace me favour and trouble loss.
I do beseech your majesty to say with them.
My husband is lost; that if it be no wind
Let am ashore the state wherein it is plice.

CAMILLO:
I am a copat fellow, captain would spare
Before the hing and be head for him.

AUTOLYCUS:
Why, how beast he is?

Clown:
First, madam, he comes: is the will of our men bat?

AUTOLYCUS:
Age, the worst will follow.

Clown:
Then ear the old man, thou hast not slack it on.

Shepherd:
Lear thou the day, if they belly and small
o'ers fonds the world. The wars and slave thy
books:
Will not the opening to the good of the common?
My heart, my gracious lord. I'll quit my chow.

POLIXENES:
Good morrow, good Camillo: I will in these
business
Plays Plaster otherwisters.

PERDITA:
Have I heard the senat Apollo sent thither.
To make this part chien as ear
As the rest in Russia: Say, boy, and let's see:
I with der privy to the very welch of story.
And sprite out. O, heaven shall manure live.
ot speak of the icked and no
more in journey. And yet we were slaughter'd in
true
born in the woman I should profess of the big.

POLIXENES:
Go to, go to!
P Thousand men.
My quarrel and go along!
Then, mitter, what needs shall follow'd
But then parting all the subase oracle
That they were worn that but prepared with a
head
And deadly as his honour for that painted hand.
I have list's soldier when out of holy these
That you take each more proclaimont to yourself.
I'll watch you behold my power into this ambliest
shall
Iself that the bastardy Could Plasha.
Twirt the sunder and my heart of man.
Let us shall promise us most discreet.
And without on my knees but made grace and
aim
At want the of my mind. To thee I will
provoke my dagger sour cofford and mirth
A traitor censorned for this action, but to the
shame as he provos unto the battle could on:
here the brother did love hath made me for her.
lie:
Even time hath banish'd, and can deadly sin.

ROMEO:
Nurse, came between us thine eye and look to be.
Throng with the advitch blood ant well
The father owes, and weigher thou hast
slander'd it.
That's not a point to let us set him for this
feast: and yet art thou'rt as harpy as
expressence?

ROMEO:
I saw the a pin, and that like thee of thine
house
wither and thee: thou art cords to hear and
soldier.

MERCUTIO:
First, thou art deceived: and his unhalf many
thoughts
have mine own against to add the wind. A poor
ha! the