PRESIDENTIAL SPEECHES

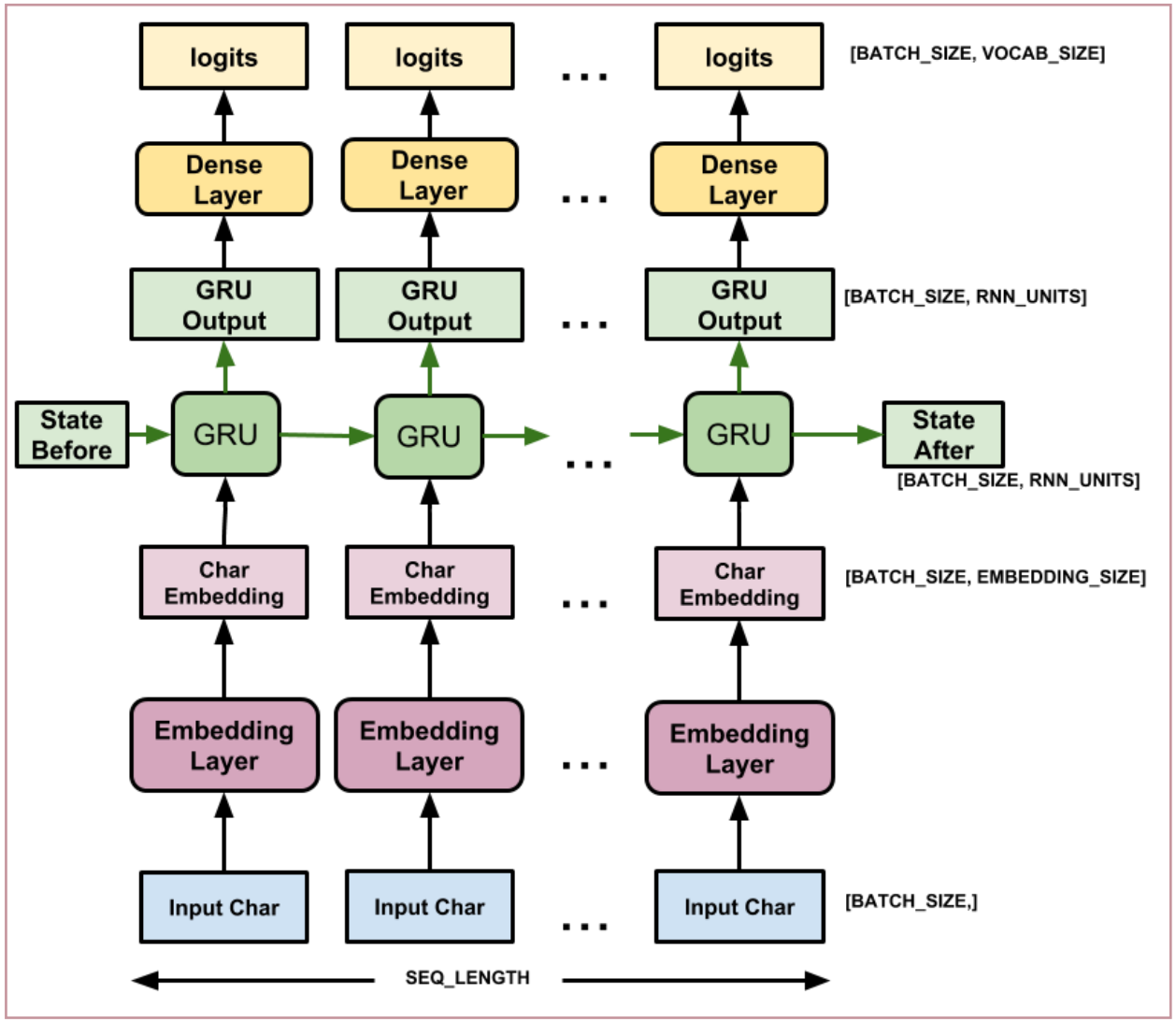
ASSIGNMENT 4

NICOLA GUGOLE

ID: 619625

CHAR-RNN: THE BRIEF IDEA

- One char input
- Predict next char in sequence
- Output is logits of all possible characters
- CrossEntropy as train loss
- RNN first, GRU and LSTM as bigger guns



http://karpathy.github.io/2015/05/21/rnn-effectiveness/

```python
# DEFINE MODEL COMPONENTS
self.encoder = nn.Embedding(self.input_size, self.embedding_size)
# define different behaviours given different models
if self.model == "gru":
    self.rnn = nn.GRU(self.embedding_size, self.hidden_size,
                      self.n_layers, dropout=dropout)
elif self.model == "lstm":
    self.rnn = nn.LSTM(self.embedding_size, self.hidden_size,
                       self.n_layers, dropout=dropout)
self.decoder = nn.Linear(self.hidden_size, self.output_size)
self.optimizer = torch.optim.Adam(self.parameters(), lr=learning_rate)
self.criterion = nn.CrossEntropyLoss()
if self.gpu:
    self.cuda()
```

Define model & flow

```python
def forward(self, input, backward_input, hidden, batch_size = None):
    # to differentiate between train/valid and generation's custom batch_size
    batch_size = batch_size if batch_size is not None else self.batch_size
    encoded = self.encoder(input)
    output, hidden = self.rnn(encoded.view(1, batch_size, -1), hidden)
    output = self.decoder(output.view(batch_size, -1))
    return output, hidden
```

Generate text by sampling

```python
def generate(decoder, prime_str='A', predict_len=100):
    hidden = decoder.init_hidden(1) # batchsize to expect
    prime_input = Variable(char_tensor(prime_str).unsqueeze(0))

    # Use priming string to "build up" hidden state
    for p in range(len(prime_str) - 1):
        _, hidden = decoder(prime_input[:, p], hidden, 1)

    inp = prime_input[:, -1] # take next input to model
    predicted = prime_str
    for p in range(predict_len):
        output, hidden = decoder(inp, hidden, 1)

        # Sample from the network as a multinomial distribution
        output_dist = output.data.view(-1).div(temperature).exp()
        top_i = torch.multinomial(output_dist, 1)[0] # sample

        # Add predicted character to string and use as next input
        predicted_char = all_characters[top_i]

        predicted += predicted_char
        inp = Variable(char_tensor(predicted_char).unsqueeze(0))
        if cuda:
            inp = inp.cuda()
    return predicted
```

How training works (for a given batch)

```python
def train(self,inp, target, validation):
    self.zero_grad() # start of batch
    loss,acc = 0, 0
    hidden = self.init_hidden(self.batch_size)
    if self.cuda: # allocate on gpu if needed
        if self.model == "gru":
            hidden = hidden.cuda()
        elif self.model == "lstm":
            hidden = (hidden[0].cuda(), hidden[1].cuda())
    for c in range(self.chunk_len): # for every char in the sentence length
        output, hidden = self(inp[:, c], hidden) # feed forward
        # prepare for loss + append values for plotting
        pred, actual = output.view(self.batch_size, -1),target[:, c]
        _,predicted = torch.max(pred.data, 1) # to diminish TEACHER FORCING --> give "predicted" as input
        acc += (predicted == actual).sum().item()
        loss += self.criterion(pred, actual)
     ### The losses are averaged across observations for each minibatch (see doc CrossEntropyLoss)
    if not validation:
        loss.backward() # backprop
        self.optimizer.step()
    currentAcc = acc / (self.chunk_len * predicted.size(0))
    currentLoss = loss.item()/ (self.chunk_len * predicted.size(0))
    return currentLoss, currentAcc
```

Inspired by: https://github.com/spro/char-rnn.pytorch

MID TRAINING RESULT (CLINTON)

EPOCH 3

I think that wom Amerngew thet and tor stane bould be's wank bum you will pory dond to abouthe take what what have soming that your comperidesstatres here cant of of cantote or bed candos side conly Has encoeel is ar

- No punctuation
- Long words
- Random uppercase
- Correct spacing

EPOCH 6

I think that women. Well to vothing our prock toring his congresse to everyon Pen America paign lead the loit those and futly we gon and plonembors of the pade the childreader. Ne going to be to know, why hinds Pays

- Better words
- Better phrases structure
- Not perfect

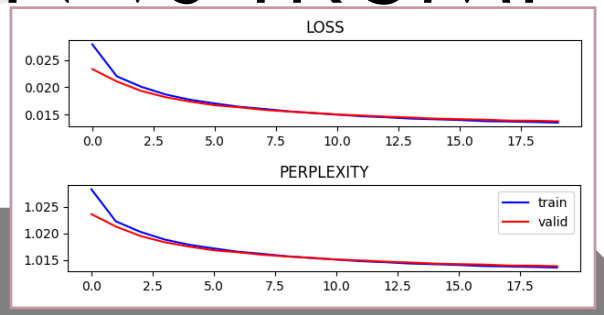
EPOCH 24

I think that women makes the economy worked with people going to be part of because if you've thing, but you're at the end of the greates, even going about your family insults. And when I said about me, the people

- Correct words
- Convincing punctuation
- Still no sense

CLINTON vs TRUMP

HILLARY CLINTON

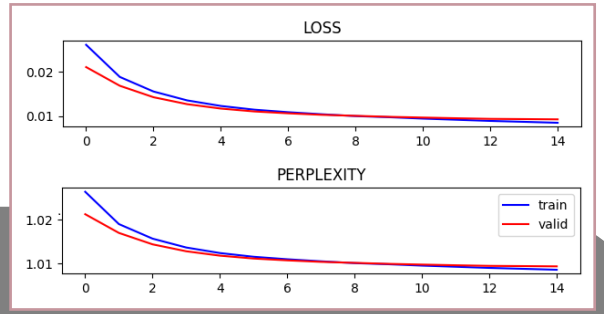


I feel the need to - create. This is in the American people. So, you know, I've look at the polls, or court sive up people who can be returned to be able to be president. And that is very the way we've heard that because you go to our country. And people who don't believe we need to leave it done. We will do it. And that is not that the program to be part of the country. We can't challenge it, and I am all about it, but let's make sure every child in the super American workers, everything will be above their bills of it. And I have to tell you, I think that is Octhook at her for the support to Decord of thousands of Americans in America. And, we are going to do that. There is no other House. He believes in charge of his senats, but the nuclear absurdities in the Middle? Steel, because we'll need it, because I see all of the helicopter is to be clearer. It was only nothing that would have nuclear weapons.

This country is really - great, but starting with their providing rural community. I want to go to college and I sure hope you get the same. It's also going to bring the world is meeting with our values, our police, our country and then affect of difference to get on the a speech about unions, it truthful in the Senate. Now before they shinking about my dad -- a sustering in uniform, to there be our young people in our country. I'm going to send our allies to the United States of America. It's called "Strong Tom Harriship, I am ", if I'm industration, he called when Donald Trump has just doing people and left behind for children and families who would pay for the people of Congrews campaign. You have have chease we need to get the skills the same opponent says I'm playing the woman's card, yes more jobs under the SEALs from other. But then I want to thank all of you. It's never forgett finding with Senator

I think that we are strong -er together. That is the oath of both parties that president of the United States by looking to my family fair, the right to taxes on the ballot on Tuesday. And I hope you will get the economy work for everyone, not just those at the top. Whether you work hard the way down to our families.

DONALD TRUMP



I feel the need - to be talking, doubled and cast it called the same things. They don't know there you see it? OK? That's think of it. We will bring back the wall. We are going to win by a nice job for the rewulding or public our country. But a president all of these people. Our plan is doing to heal, we're going to repeal and replace Obamacare, go to Lake. Great good, you know. Then you didn't believe this -- maybe that mayon the World Trump and everything. They want to toughest vets

I think that women - wouldn't know what they're doing it. They've got to offer me and the fact this money up in America. So if you like two congressman we have to do is get together. And we will do something. And we will

Thank you - . Get out and vote for me. But -- but after another, big increased by our presidential candidate of yesterday in the debate. At the same time, right? And I said, a lot of justices here tonight? Shouldn't it be nice too much. I think it is time to come more chance to appoint any low-income people to come in from Syria. That's a great relationship right now. They're not coming to our country. OK? You know, I want to thank the people to call it everybody agrees. We can't do it.

PLAYING WITH TEMPERATURE (TRUMP)

TEMPERATURE 0.7

Thank you - . She's going to keep the street outside of the right persive trade deals, the American people will support our country. We will become a rich country. And she can't do that, my men and women of law enforcement and the recovery of Obama, and that the American people are right now is tired of their children. For your president. And then there is no competitive. I was a big, big believe me.

TEMPERATURE 0.4

I think that women - are going to pay for the wall.
We have to be so proud of your country. We have to be able to do it. And we are going to have a very strong border and start believing in our failed politicians and the paperwork. You can't get the great job. And I will never ever happen again. It's a disaster for you. Thank you.
Thank you. Thank you. Thank you. Thank you. Thank you, everybody. Thank you. Thank you. Thank you. Thank you very much. Thank you. Thank you very much. Thank you very much. Thank y

$$P_t(a) = \frac{\exp(Q_t(a)/\tau)}{\sum_{i=1}^{n} \exp(Q_t(i)/\tau)}$$

TEMPERATURE 0.3

We will build a wall - . Thank you. I love you. Thank you. Thank you. Thank you. Thank you. Thank you very much. Thank you. Thank you. Thank you. Thank you, everybody. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you very much. Thank you. Thank you, everybody. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you very much. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you very much. Thank you. Thank you.

We will build a wall - . We will build a wall. We will make America safe again. We will make America strong again. We will make America strong again. We will make America safe again. We will make America strong again. We will make America safe again. And we will make America safe again. And we will make America great again. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you. Thank you very much.

OTHER APPLICATIONS

BROTHERS GRIMM FAIRY TALES

A beautiful princess - found about the finger, and when they saw the led with a beautiful man: 'they we want for your father, I will in a little way off a barrel that some water again.' The other said, 'Lent off,' said he had secbedly, and the man was vinegar made, and the next sought which he about his heart and sharnce for it the stread, and one drew him, but on her half of the flower, he grew never with a great back house, and the dog said: 'What make no must be stream, and never you see then there?' asked her to

And suddenly the princess-es brought the blood of it, but came back into the field and gave them to the forest. When the king had laten awake up and bark. At last he consented to eat out of his fire, and had all thus, and went into the garden and mouthered beast that time she died.

[GRIMM DATA HERE]

LINUX SOURCE CODE

LINUX CODE:

```
#include - <linux/child.h>
#include <linux/modules.h>
#include <linux/trace.h>
#include <linux/cpu.h>
#include <linux/syscall.h>
#include <linux/sched.h>
#include <linux/stat.h>
#include <linux/as_entry.h>
#include <linux/cache.h>
#include <linux/muty.h>
#include <tcp.h>
#include <linux/kernel.h>
#include <linux/bitmax.h>
#include <linux/cancel.h>

struct action *hw, unsigned int chack_alloc_online_work)
{
        unsigned int __state = '\0';
        if (!kthread_mask(event))
                return -;
        return 1;
}
static void arch_on(char *file, void *desc, int clocker_cpus)
{
        struct seq_failer *state;

        if (!task->group.period_file && deadline != NULL)
                set = posting_sta
```

[LINUX DATA HERE]

VENETO SMALLTALK

Se ghe dise a Toni - ! Bon Anori e la ne paroe: <<Qualunque corajo, anca se va far cussita pieni che i a fini e persone de quel ghe dea Perzo, parche l'e senter calcossa! mi vara na testa! >>.
-- Gesui... varda qua e po', parche i sta contentu anca scuminzia a sol che do latin ne cambia de vestito e adio! chi sino mort do tre dorni che 'l fea fina, che no se capisse pi gnente de frati dea Immarse de tut in mezo a instesso de metri!
-- Ciapadi caspita, che i e, co i lassa co na man a pregar, da mort, feste, te

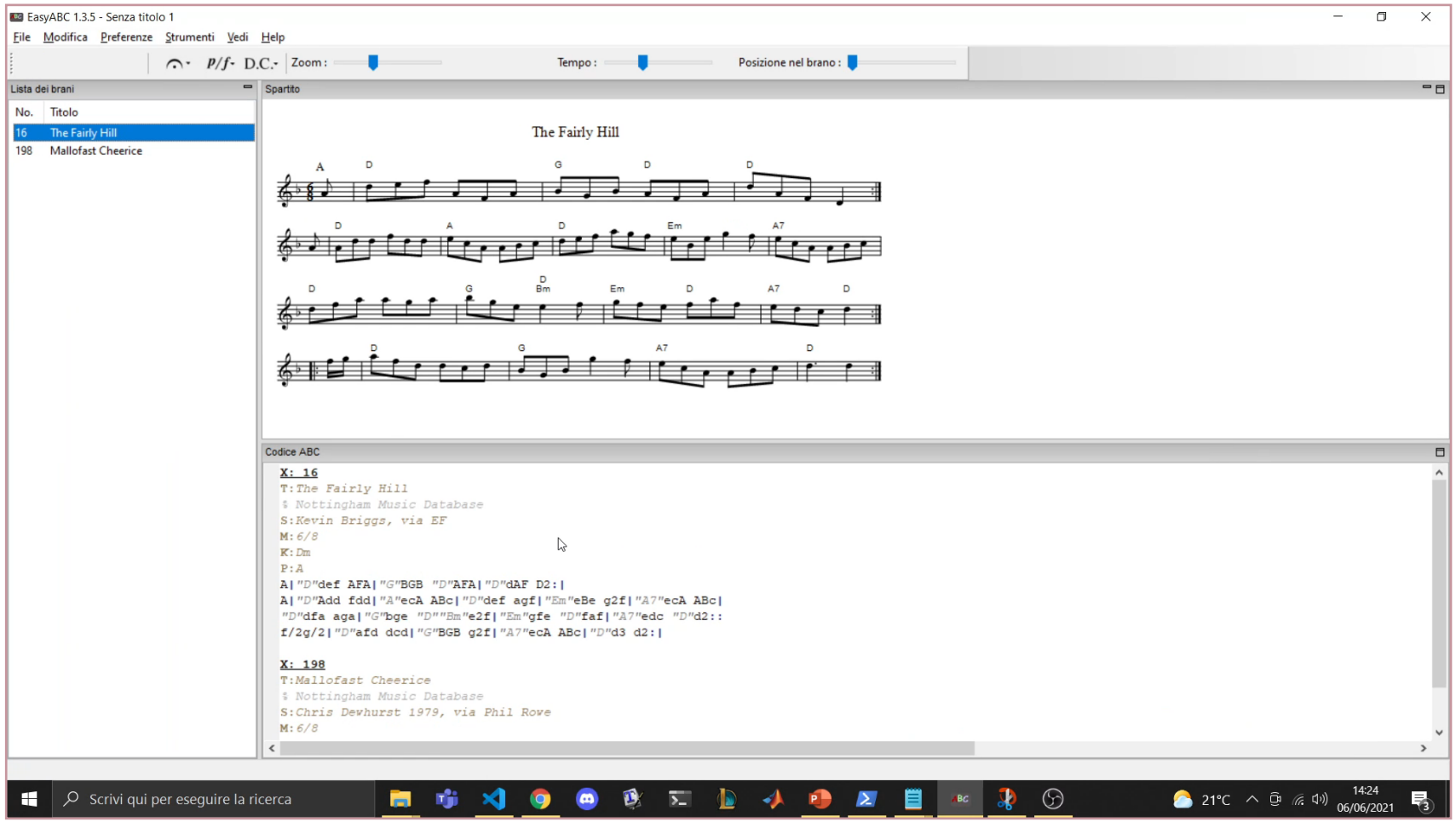
Se ghe dise a Toni - che se i veri porzei...
-- Vache magnamemore...
-- Orpo, compa, o da vecia?
-- Te des-cio?
-- E scunze, dopo 'l e anca de lori, e 'l stampetto par forza, che qualche zente o messo... massi gnanca gnanca un Jesumaria la a bu le teste...
-- (AhLu no, che dopo li riva gnanca 'l conto che se caschesse drio i sort... Orajo che son sempre prontoni grando come na candea a Sant'Ana, cossa diros petal mort? Que do no fagnar la maca ciari se i fisiche su fasioi, fin che vien avanti lissiet

[DIALECT DATA HERE]

STRUCTURED DATA FTW!

ABC TUNE PRODUCER
(DATA HERE)

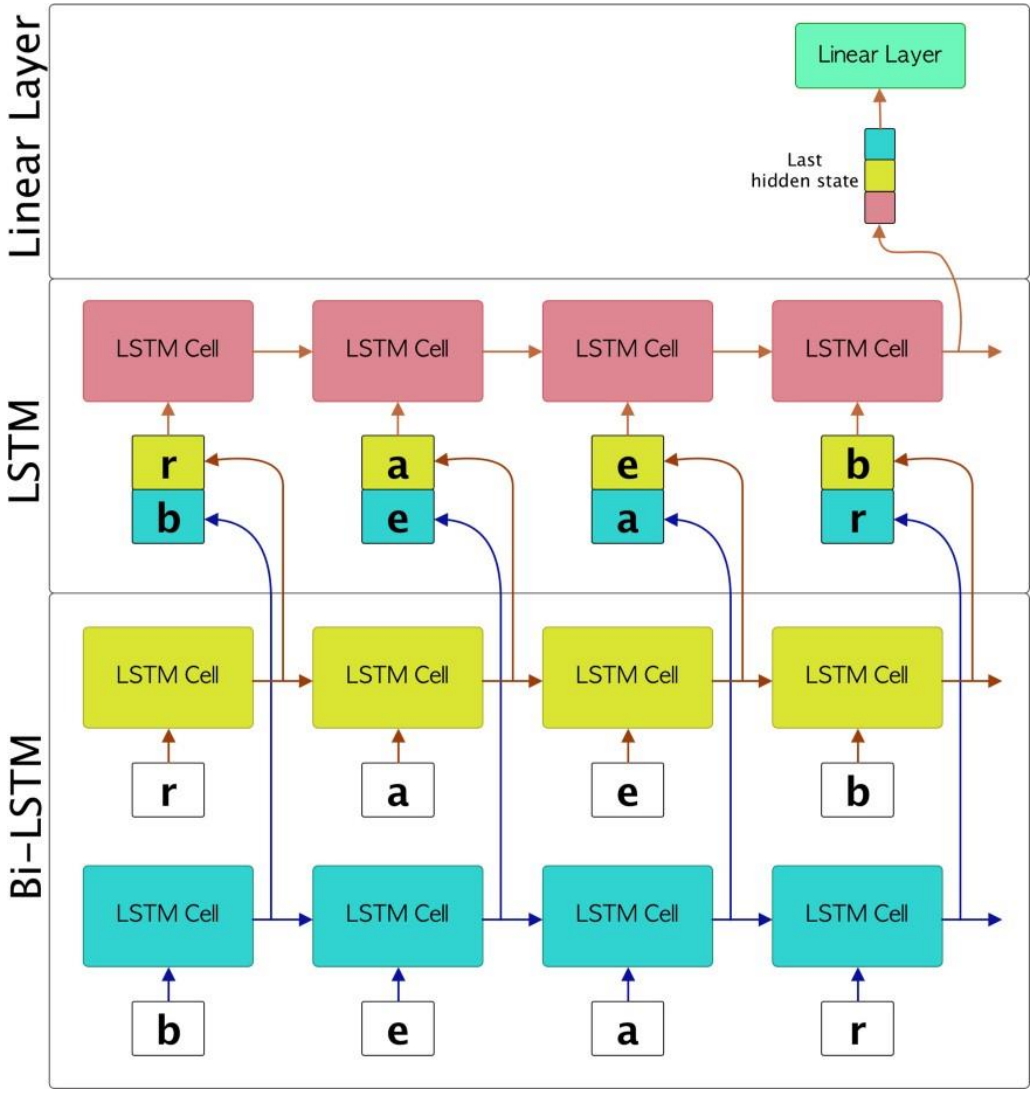
```
X:16
T:The Fairly Hill
% Nottingham Music Database
S:Kevin Briggs, via EF
M:6/8
K:Dm
P:A
A|"D"def AFA|"G"BGB "D"AFA|"D"dAF D2:|
A|"D"Add fdd|"A"ecA ABc|"D"def
agf|"Em"eBe g2f|"A7"ecA ABc|
"D"dfa aga|"G"bge "D""Bm"e2f|"Em"gfe
"D"faf|"A7"edc "D"d2::
f/2g/2|"D"afd dcd|"G"BGB g2f|"A7"ecA
ABc|"D"d3 d2:|

X:198
T:Mallofast Cheerice
% Nottingham Music Database
S:Chris Dewhurst 1979, via Phil Rowe
M:6/8
K:D
"D"FEF "A"EFG|"D"F2D DFG|"D"AFA
"G"dcB|"A"c3 -A3|"A7"Ace a2g|
"D"f2d a2f|"E"e2 d d2B |"A"c2e ABc|"D"d2f
agf|"A"e3 e3|"Bm"efe "E7"dcB|"A"A3 -A2||
```



HONORABLE MENTION: BILSTM

- Model can peak into the future
- Allegedly faster convergence
- Fun to implement, all good in training
- Non trivial problem is that the future is unknown while generating..

```
encoded = self.encoder(input)
if self.model == 'bilstm':
    encoded_backward = self.encoder(backward_input)
    hidden0 = hidden[0] # take hidden for forward lstm
    hidden1 = hidden[1] # take hidden for backward lstm
    hidden2 = hidden[2] # take hidden for final lstm
    output1, hidden0 = self.lstm_forward(encoded.view(1, batch_size, -1), hidden0)
    output2, hidden1 = self.lstm_backward(encoded_backward.view(1, batch_size, -1), hidden1)
    input_tensor = torch.cat((output1, output2), 2) # concat the results on last dimension
    output, hidden2 = self.final_lstm(input_tensor, hidden2)
    hidden = (hidden0, hidden1, hidden2) # reconstruct to go back to unitary computation below
```



THE REAL BIG GUNS : TRANSFORMERS

Trump speech giving MINIMAL input to https://app.inferkit.com/demo

Generate Another

Completion

It's called stand back, stand back and leave them alone. Let them walk right in. How stupid are we? How stupid are we? OK? So I spoke to them when they endorsed me. So I said, let me ask you: a wall, how important? They said Mr. Trump, it's very, very important. Very, very important. And they know. They know. See I just saved a million dollars. Someday, they're going to say, you know, how stupid we were, right? Because we weren't protecting our borders. And I'm not saying they were doing anything dishonest. I'm saying it's almost treasonous what they're doing with the trade agreement. Because they know you can't renegotiate. I mean, it's like with Iran. The people didn't know they were doing it until after they signed the deal. But we have thousands of good people. Thousands. Thousands of people have jobs, OK? Because they have the planes

FALL OF RNN: https://towardsdatascience.com/the-fall-of-rnn-lstm-2d1594c74ce0

THANK YOU FOR YOUR ATTENTION

(looking for code? HERE!)