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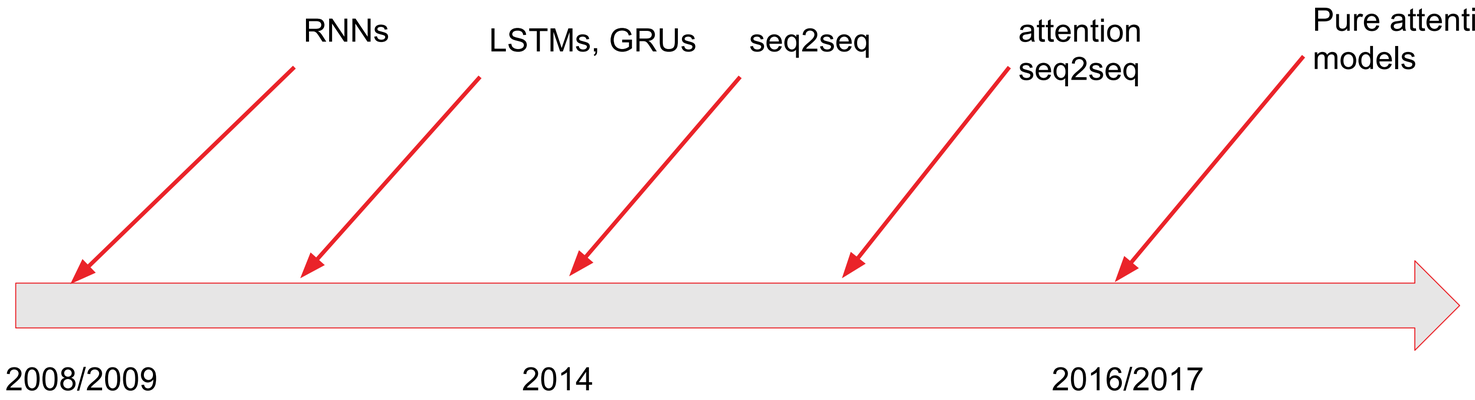
Basic RNNs (Part 2)

Outline

- Text Generation (Short Term Prediction)
  - Seq2seq example
  - Teacher Forcing
  - Shortcomings
- Complex Environment Simulations (“Dreamplay” - a toy example)

Network Structures

RNN Evolution (in NLP)

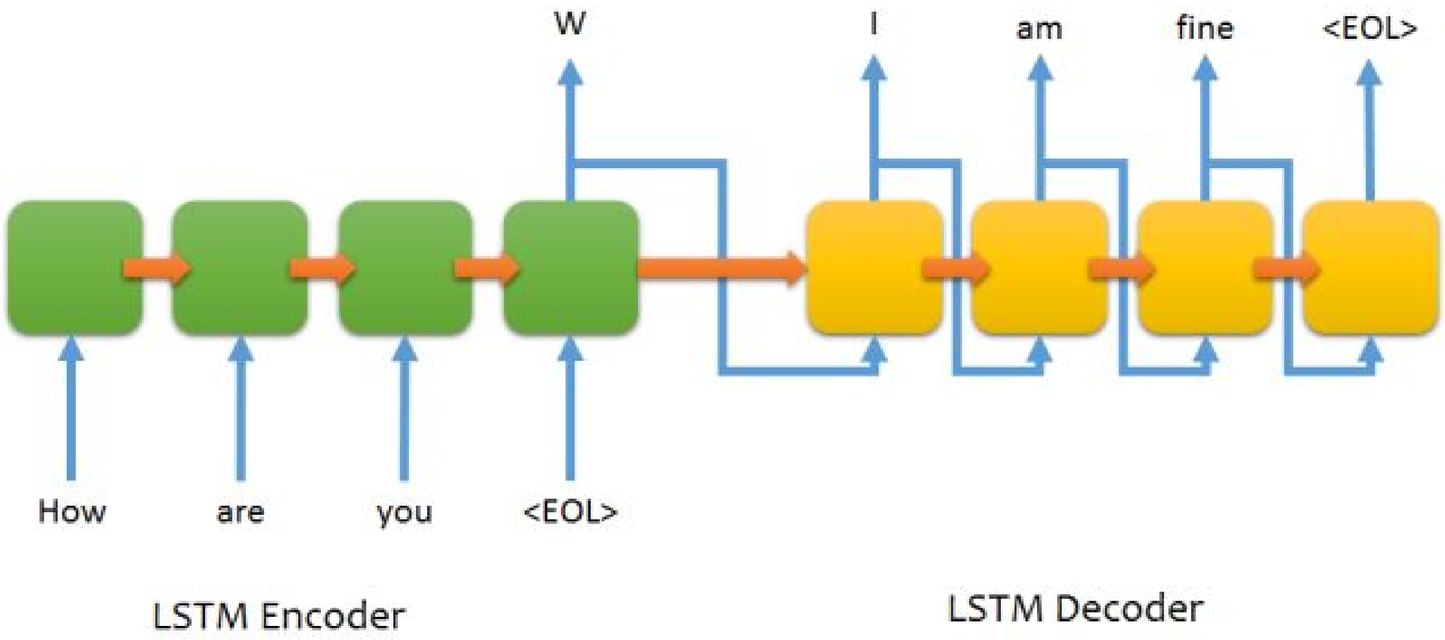


It takes a lot of time to train:

(+ 1, 2 weeks to train in 1 GPU)

Modelling Sequences

Encoder-Decoder Models



Example: Neural Storyteller

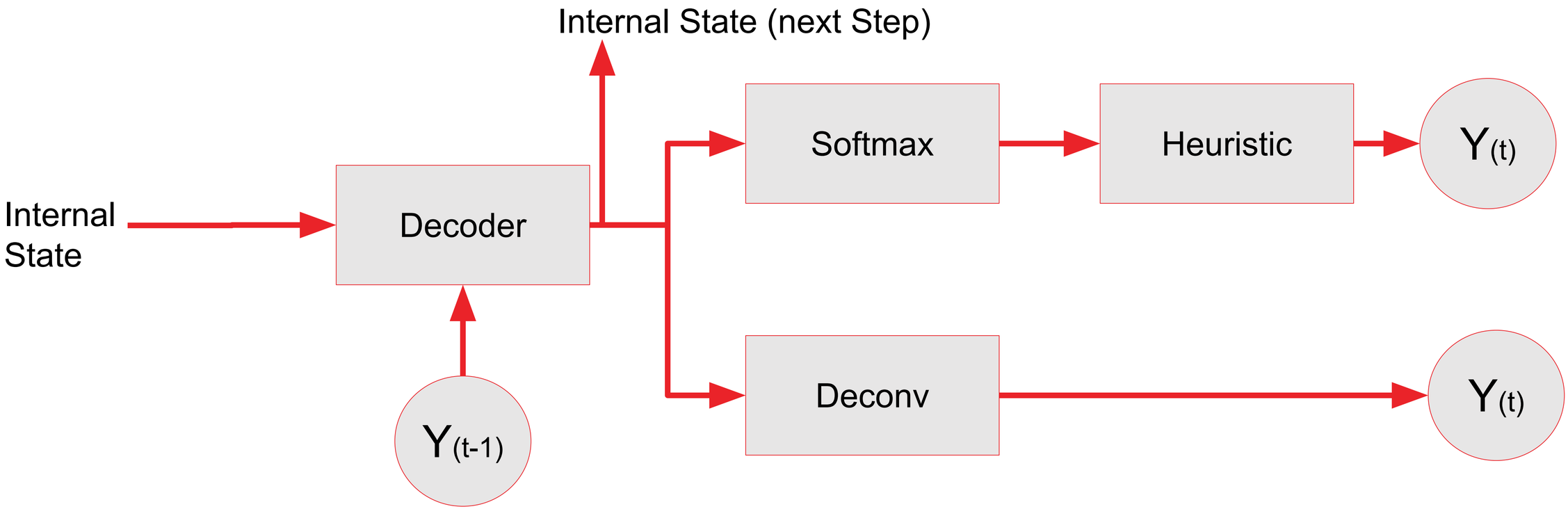
Generating stories from Images

Image 42 	Mountain sheep were grazing on the edge of the forest . As I watched , he maintained the silence and listened intently . No matter how many hours I can tell you , I must have been more careful . A flock of sheep grazed in the shade of a grove of trees . A flock of sheep moved in the middle of their path , which seemed to be the most natural thing in the world . I did not know when I was in the field , but I m not certain that . I just wanted to test their mettle by the spirit of the elders , so did I ?

https://github.com/ryankiros/neural-storyteller

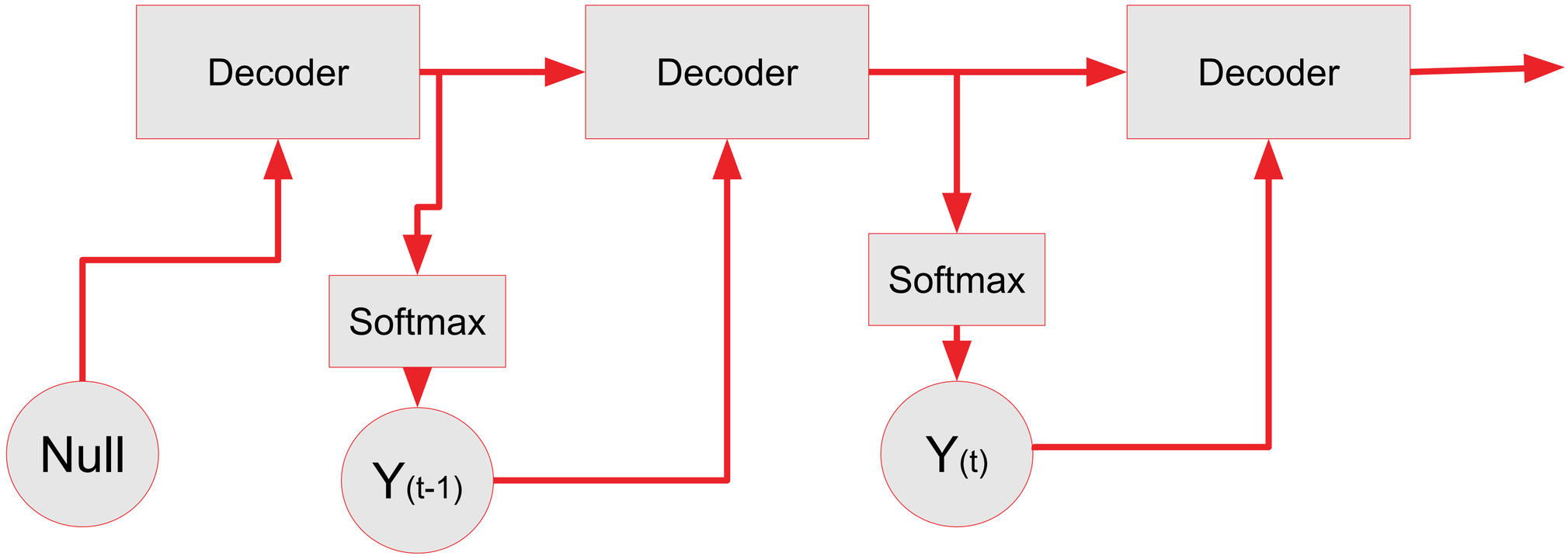
Modelling Sequences

Decoder



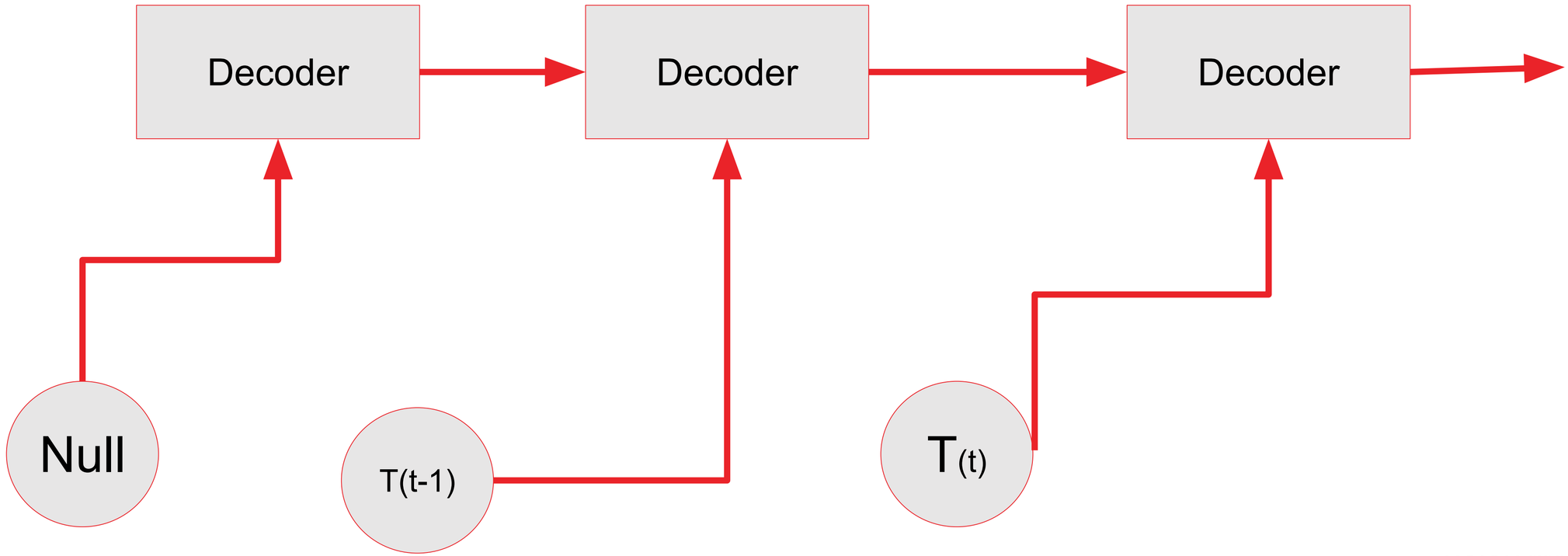
Modelling Sequences

Generating Predictions (NLP)



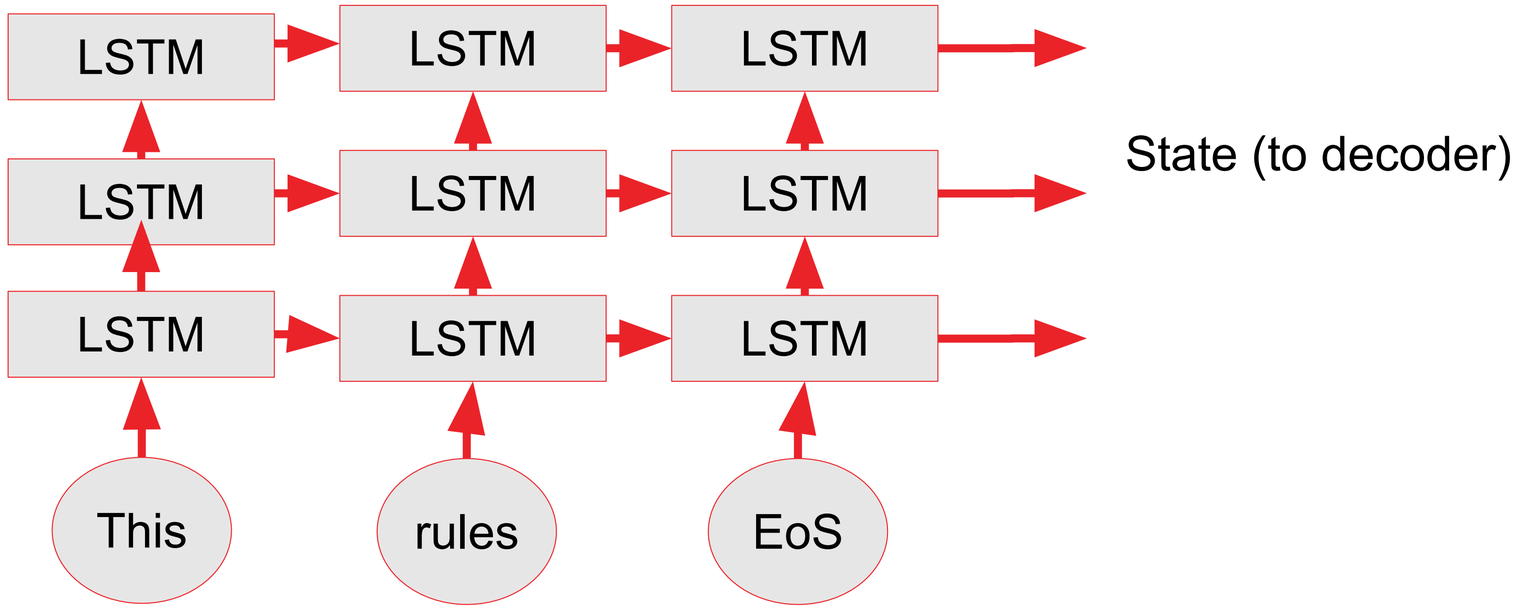
Modelling Sequences

Training Teacher Forcing (NLP -> Generative Models)



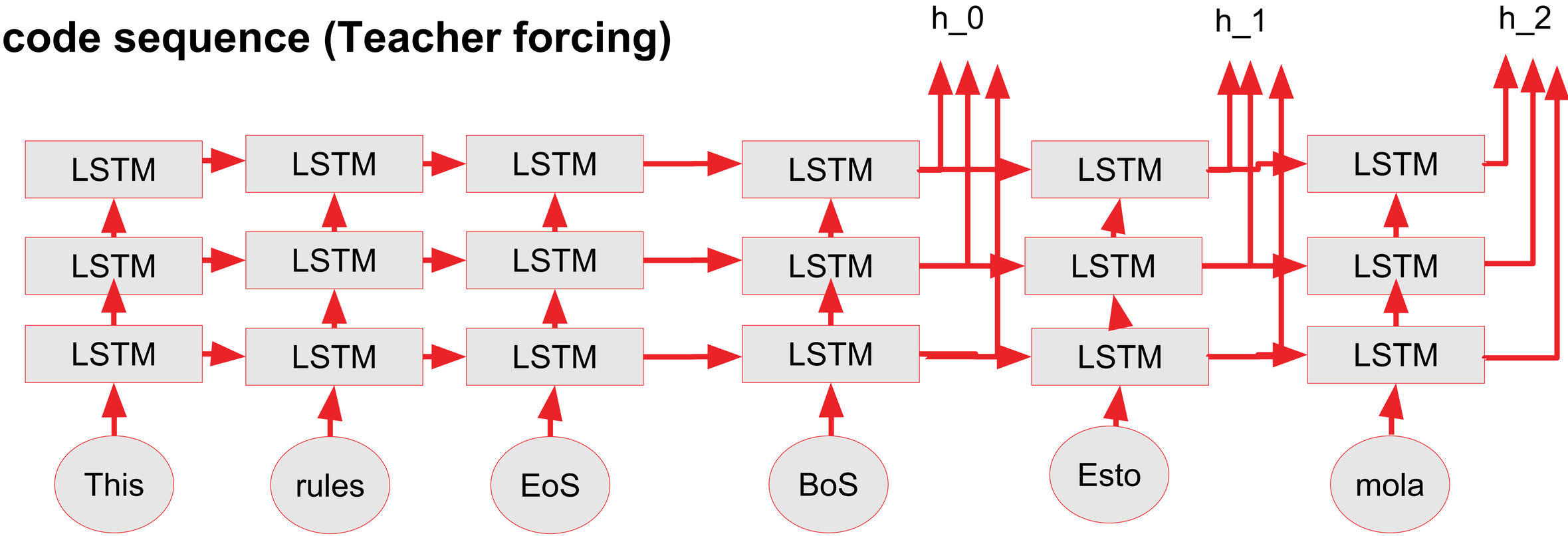
Seq2seq Training (Step 1)

Encode sequence



Seq2seq Training (Step 2)

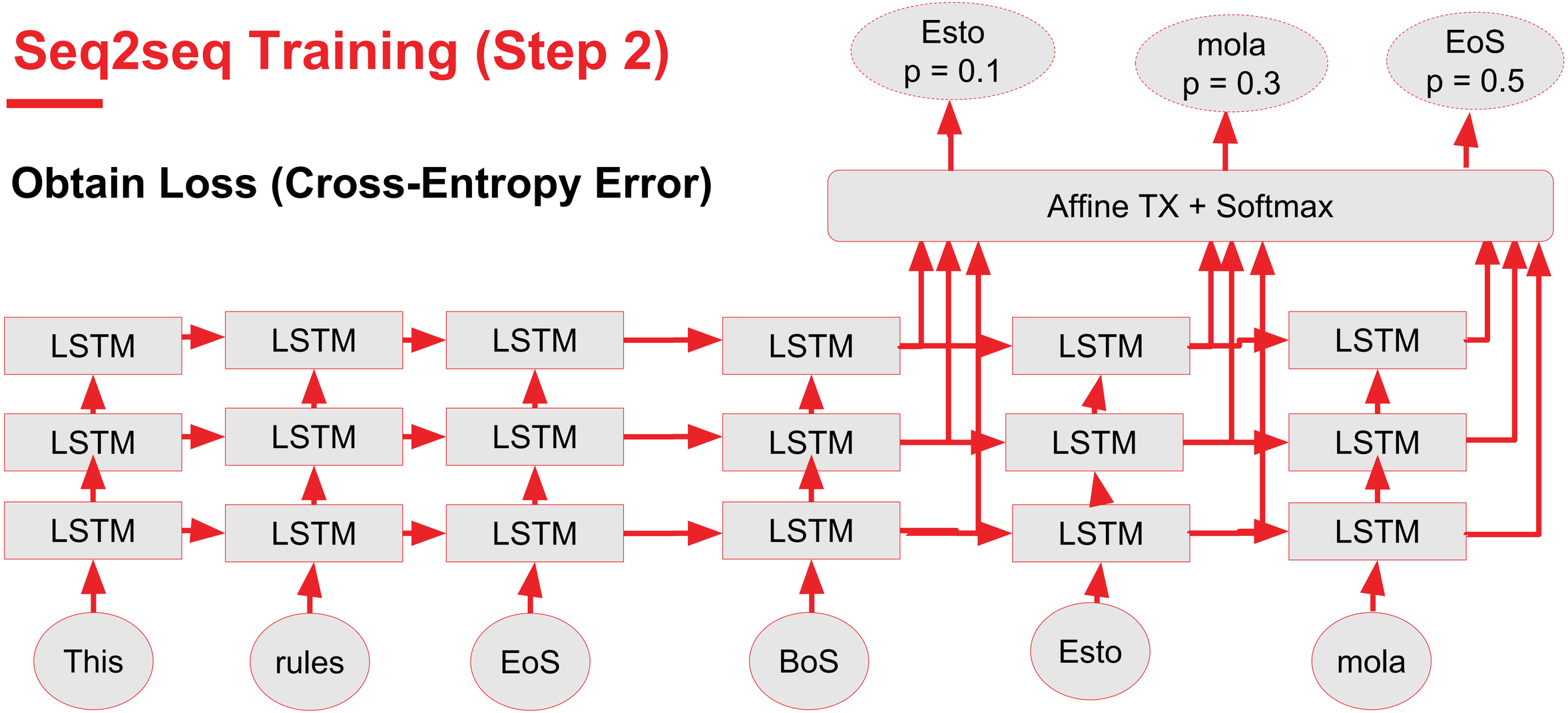
Decode sequence (Teacher forcing)



Targets (Shifted by 1). Input in the next step

Seq2seq Training (Step 2)

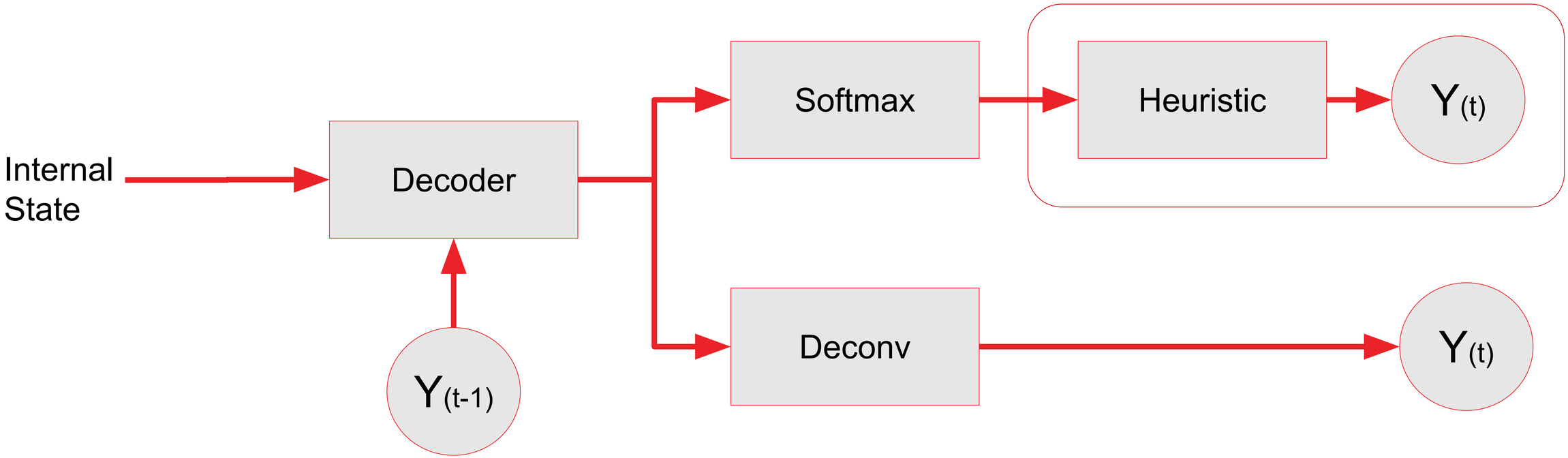
Obtain Loss (Cross-Entropy Error)



Targets (Shifted by 1). Input in the next step

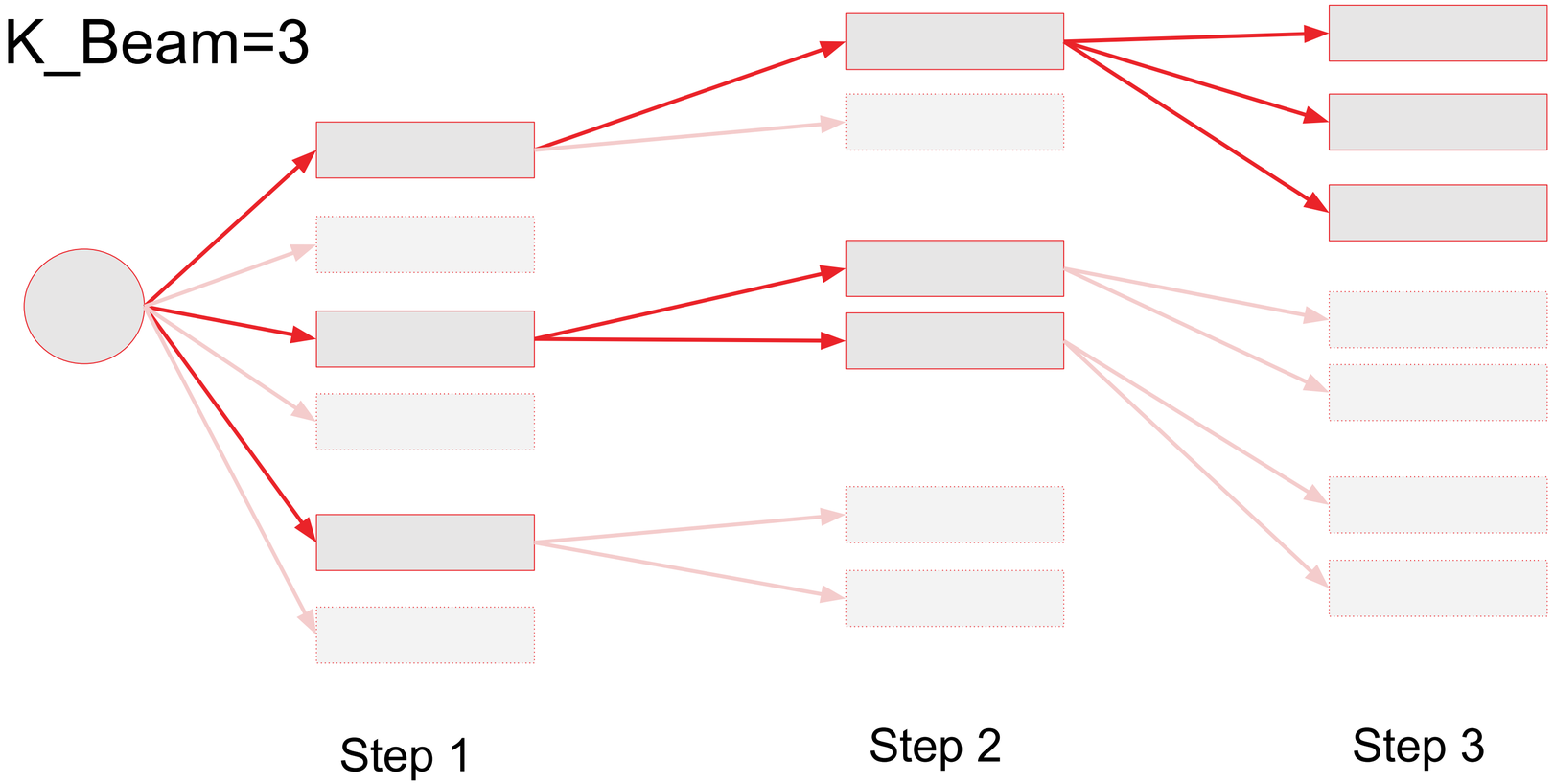
Modelling Sequences

Problem: Generating samples



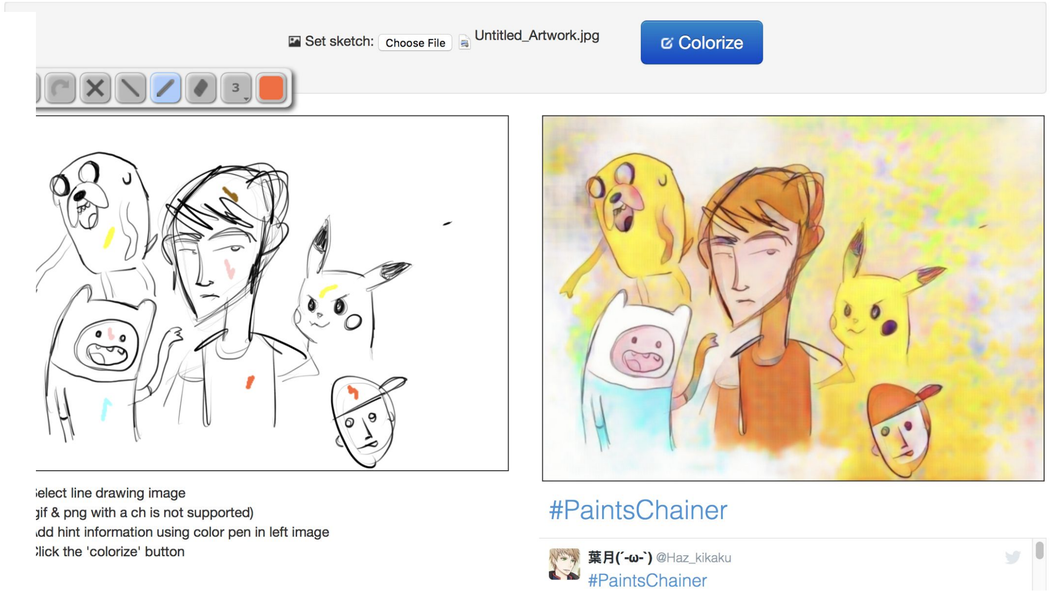
Modelling Sequences

Generating samples (Beam Search)



Implementation

Chainer: powerful, flexible and intuitive framework for Neural Networks



Seq2seq: predictions

Problem: Word/Character repetitions

la junta instalará 380 nuevos contenedores para renovar los contenedores de contenedores de residuos

el hotel de la reconquista , un año más en el hotel de la reconquista

el propietario de un bar de oviedo se encuentra en el banquillo por el robo de un bar

el psoe de ferrol se queda sin el psoe tras la ruptura del bipartito

el juez pide al juez que investigue la investigación de la uco

Seq2seq: predictions

Problem: Diversity!!


```
 88   `` i 'll be right back . ''
 97   i know .
109   no .
116   `` i 'm sorry . ''
125   he asked .
127   `` i do n't know .
137   `` i 'm sorry .
137   i was n't sure what to do .
139   `` i do n't know . ''
161   `` i 'm not sure .
166   `` i 'm not going to let you go . ''
181   `` what ? ''
246   `` i 'm not sure . ''
255   i dont know .
277   i asked .
```

Modelling Sequences

Problem: Generating samples (Unknown words)

1. encuentran consuelo en un cadáver en un accidente de tránsito
2. un hombre mata a su madre en un zoo de australia
3. un hombre pierde a su madre en un zoo de australia
4. un hombre salva a su madre de morir atropellada por un videojuego

Koala is unknown by our system

Un peluche, consuelo para un koala huérfano

Su mamá murió atropellada y él se salvó de milagro. Los veterinarios encontraron una curiosa forma para que pueda salir adelante.

Un peluche, consuelo para un bebé koala (AFP)

(3) comentarios

Australia

Un koala australiano que perdió a su madre en un accidente encontró consuelo en un peluche en forma de marsupial que le ofrecieron para recuperarse del trauma de su muerte.

La madre de Shayne, un koala de nueve meses, murió atropellada por un coche en el Estado de Queensland, en el este de Australia.

Headlines Generation

A good example

los warriors de curry , a tope en la final de la nba

Golden State Warriors vencen en Cleveland a los Cavaliers y se sitúa a una victoria del título

Durant anotó un triple a falta de 45 segundos que resolvió el partido a favor de los visitantes

Efe/Cleveland | 08.06.2017 | 08:52

Las figuras del alero **Kevin Durant** y el **Stephen Curry** volvieron a brillar de manera especial en el tercer partido de las Finales de la NBA al destrozar con su juego ofensivo a la defensa de los Cavaliers de Cleveland que perdieron de locales 113-118 ante los Warriors de Golden State.

- **Final de la NBA**: Resultados

Durant, con 31 puntos, incluido un triple decisivo a falta de 45 segundos para el final del tiempo reglamentario, lo dejaron líder del ataque y también como el jugador clave que mantuvo a los Warrior invictos en los playoffs (15-0) y **con la ventaja de 3-0** en la serie ante los Cavaliers, actuales campeor de liga.

Tips

Know your framework

Use all the functionality available, gather a library of layers/models, etc.

```
# hx1 is #seq x #batch x #dim
print ("HX_1 ", hx_1.data.shape)
pctx_1 = self.affine_tx_l(F.reshape(hx_1,
                                    shape=(length_hx1 * batch, -1)))

pctx_1 = F.reshape(pctx_1, shape=(length_hx1, batch, -1))

pctx_2 = self.affine_tx_r(F.reshape(hx_2,
                                    shape=(length_hx2 * batch, -1)))
```

A state is typically composed of Layers, Batch, Sequence, Vector Dimension…

(check every step!)

Tips

Weight Normalization: A simple Reparameterization to Accelerate Training of Deep Neural Networks

$$\mathbf{w} = \frac{g}{||\mathbf{v}||}\mathbf{v}$$

```
118     if options['wn']:
119         g_W = tparams[_p(prefix, 'g_W')]
120         g_U = tparams[_p(prefix, 'g_U')]
121         g_Wx = tparams[_p(prefix, 'g_Wx')]
122         g_Ux = tparams[_p(prefix, 'g_Ux')]
123
124         W = l2_normalize(W) * g_W
125         U = l2_normalize(U) * g_U
126         Wx = l2_normalize(Wx) * g_Wx
127         Ux = l2_normalize(Ux) * g_Ux
128
```

```
472
473def l2_normalize(x, epsilon=1e-12, axis=0):
474     # FIXME: use epsilon
475     return x / tensor.sqrt(tensor.max(
476         tensor.sum(x**2, axis=axis, keepdims=True)))
```

Código https://github.com/openai/weightnorm

Simulated Environments

Planning in Agents (Long Term Prediction)

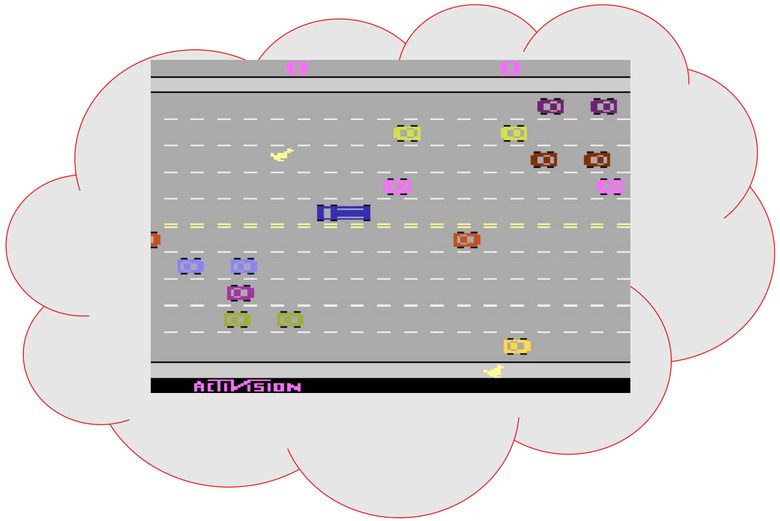
Given a state, predict the future states conditioned on user/agent actions

- RNNs
- Faster to train
- Curriculum learning

Recurrent Environment Simulators: https://arxiv.org/abs/1704.02254

Dreamplay

Playing with RNN predictions

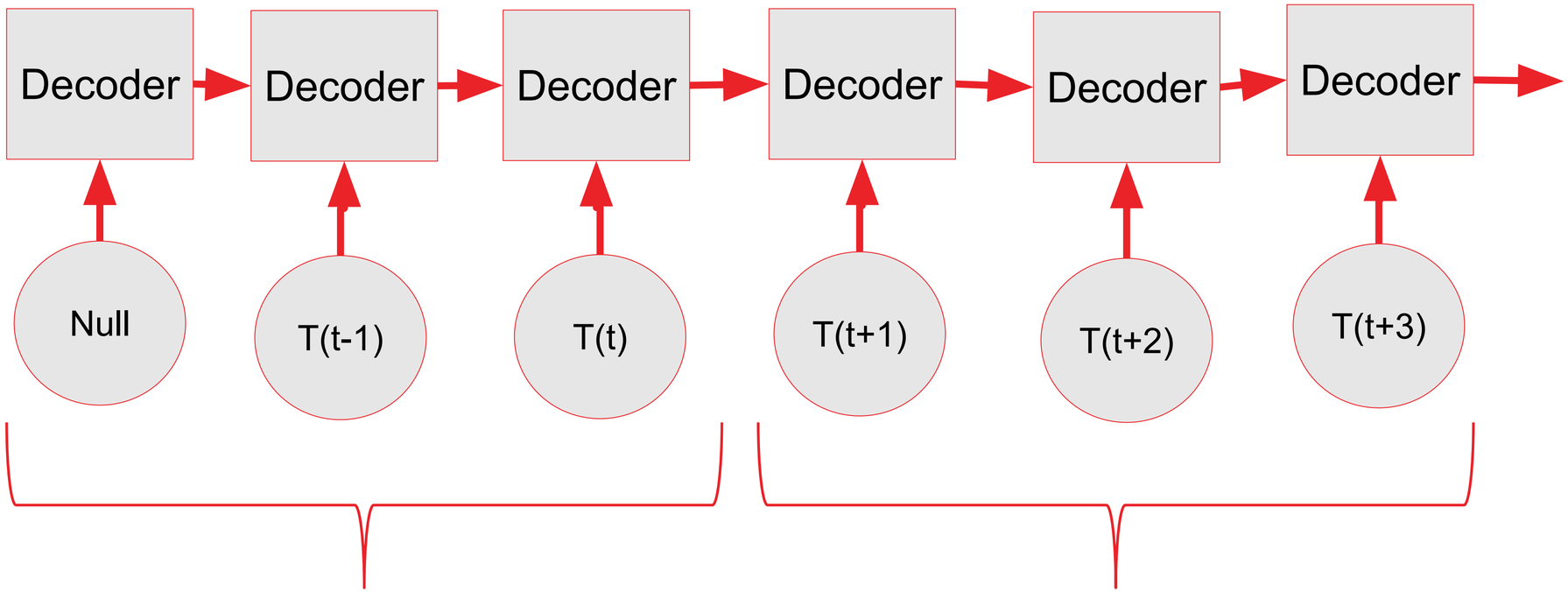


Synchronization

DNN

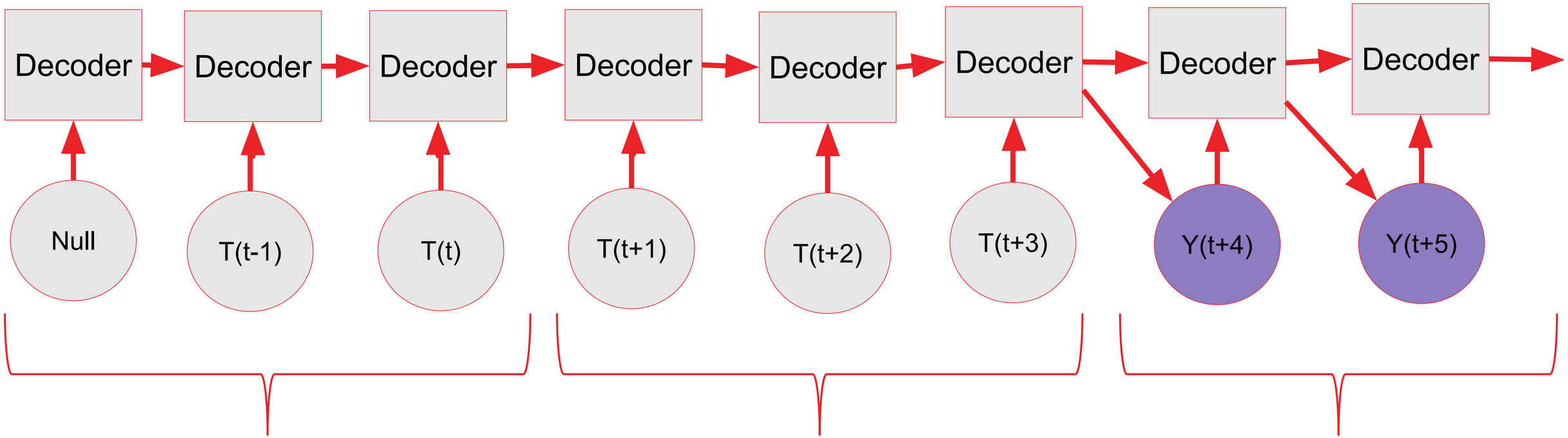
Curriculum Learning

Initial Steps: using Ground Truth as input



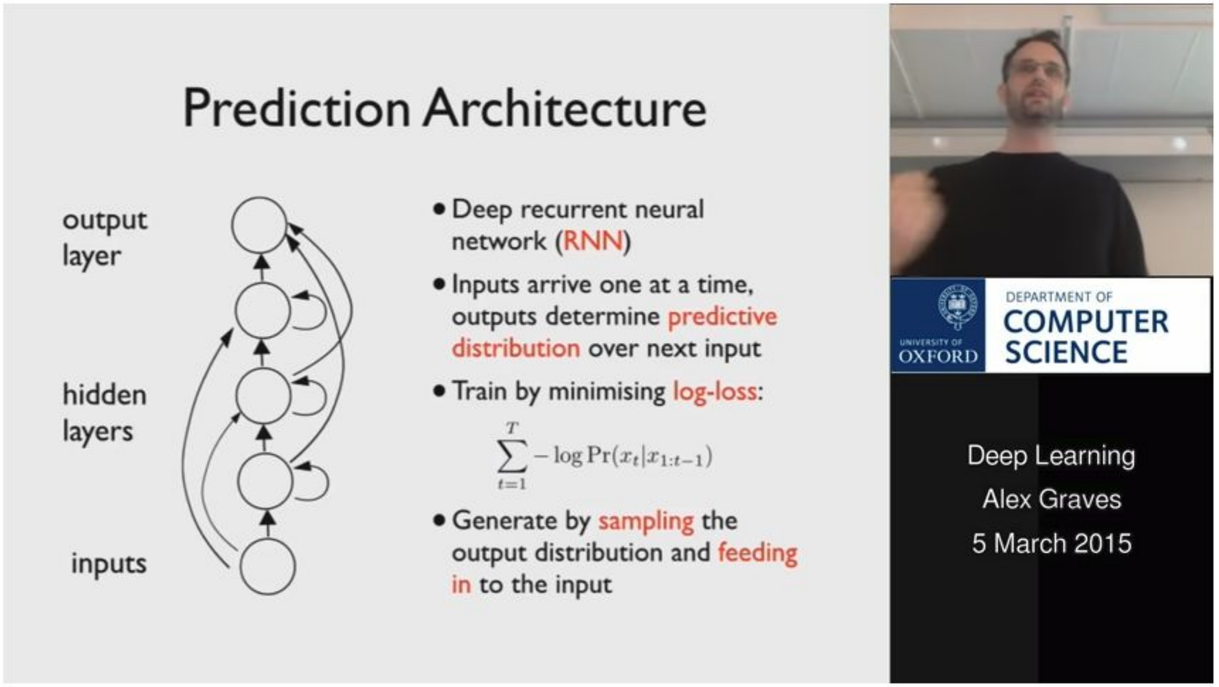
Curriculum Learning

Next Steps: use only prediction steps after observation prediction steps



Further Info

Alex Graves on Hallucination with RNNs



https://www.youtube.com/watch?v=-yX1SYeDHbg

… and that's all folks

Where is the code

- Text Generation
  - https://github.com/davidjimenezphd/sharingGroupML_DL/tree/master/notebooks/deep_learning
- Dreamplay
  - https://github.com/hmightypirate/recurrent-simulator

Known issues, simplifications, etc. are in the code, so

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