B.Y.O.(C).B

Build Your Own (Chat) Bots

About me

- Chief Data Scientist @ Boost AI
- Machine learning enthusiast
- Kaggle junkie (highest world rank #3)
- Interested in:
  - Automatic machine learning
  - Large scale classification of text data
  - Chatbots

I like big data
and
I cannot lie

What are chatbots?

- Chatter bot
- Simulate human behavior
- Natural language processing
- Virtual assistants

Examples of chatbots

- A.L.I.C.E
- ELIZA
- Cleverbot
- Jabberwacky
- James (boost.ai)

Chatbot wars

ALICE vs ELIZA

Hello

Hi there!

Please go on.

Narration continues...

Narration continues...

OK.

I'm not sure I understand you fully.

That's good information.

Tell me more about that.

OK I will tell them when I see 'em.

Julie Bot vs ALICE

Hello

Hello.

Hi there!

how r u

I am not sure if I can quantify the answer. There might be more than one.

insane

I always try my best.

Do you play any sports?

I like to play the Turing Game.

ya

https://www.botlibre.com/browse?browse-type=ChatWar

Types of chatbots

- AIML pattern and rule based
- Sequence to sequence
- Intent based

Pattern or Rule Based

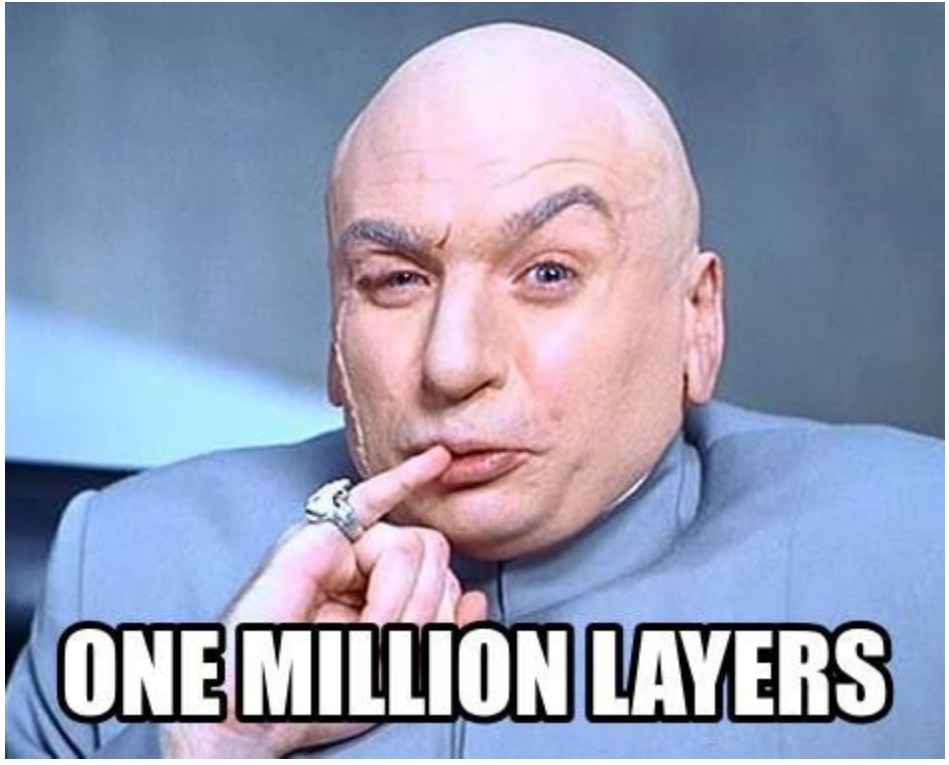
```
<aiml version="1.0.1" encoding="UTF-8">
  <category>
    <pattern>HELLO</pattern>
    <template>
            Well, hello!
        </template>
  </category>
  <category>
    <pattern>WHAT ARE YOU</pattern>
    <template>
            I'm a bot, silly!
        </template>
  </category>
</aiml>
```

Pattern or Rule Based

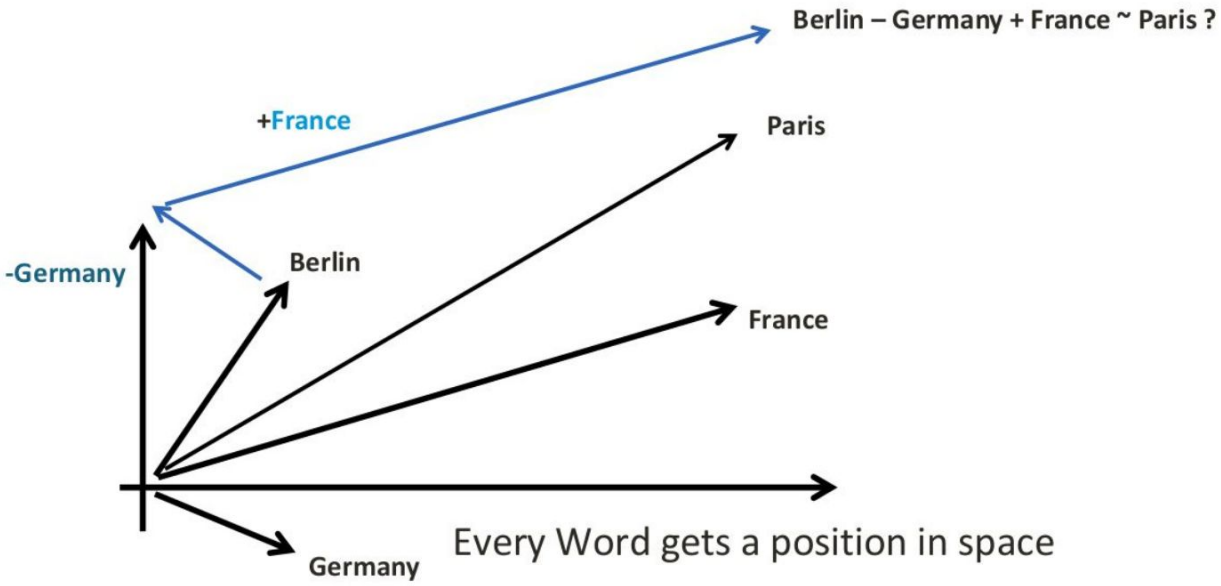
```
<category>
  <pattern>ONE TIME I *</pattern>
  <template>
    <random>
      <li>Go on.</li>
      <li>How old are you?</li>
      <li>Be more specific.</li>
      <li>I did not know that.</li>
      <li>Are you telling the truth?</li>
      <li>I don't know what that means.</li>
      <li>Try to tell me that another way.</li>
      <li>Are you talking about an animal, vegetable or mineral?</li>
      <li>What is it?</li>
    </random>
  </template>
</category
```

http://www.devdungeon.com/content/ai-chat-bot-python-aiml

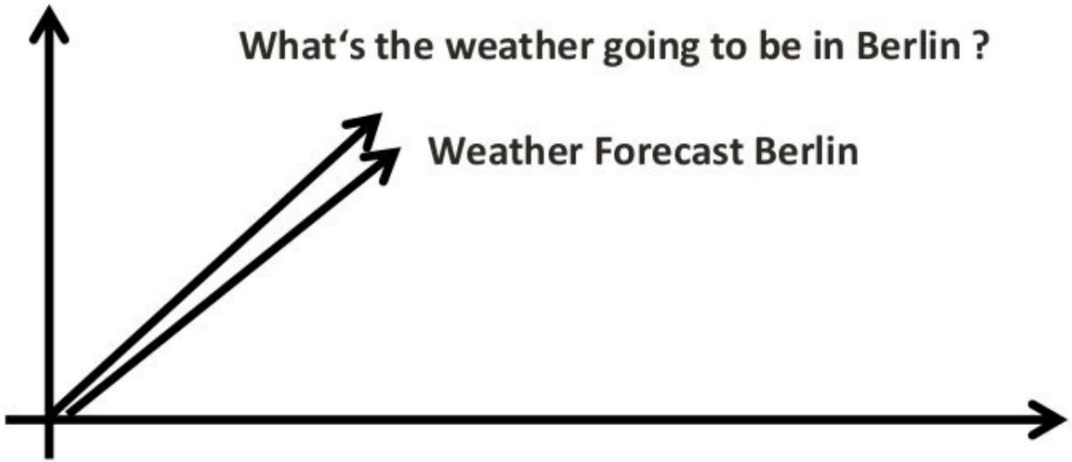
Deep Learning



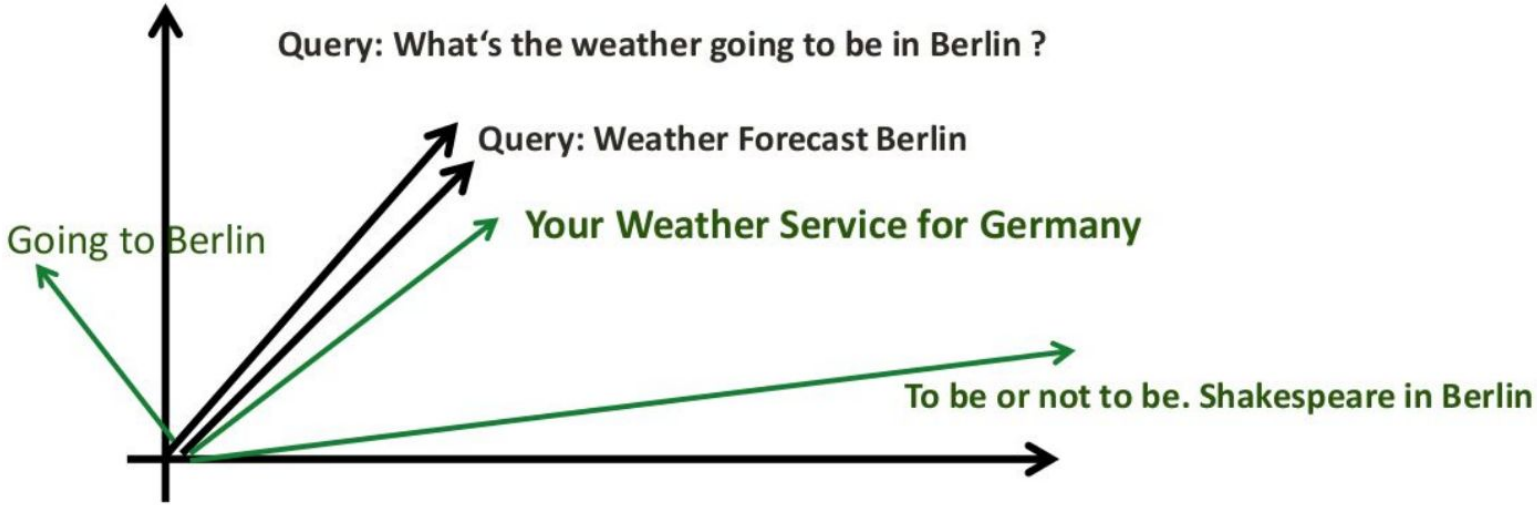
Word2Vec


Berlin – Germany + France ~ Paris ?
+France
Paris
-Germany
Berlin
France
Germany
Every Word gets a position in space

Word2Vec


What‘s the weather going to be in Berlin ?
Weather Forecast Berlin

Word2Vec


Query: What's the weather going to be in Berlin ?
Query: Weather Forecast Berlin
Your Weather Service for Germany
Going to Berlin
To be or not to be. Shakespeare in Berlin

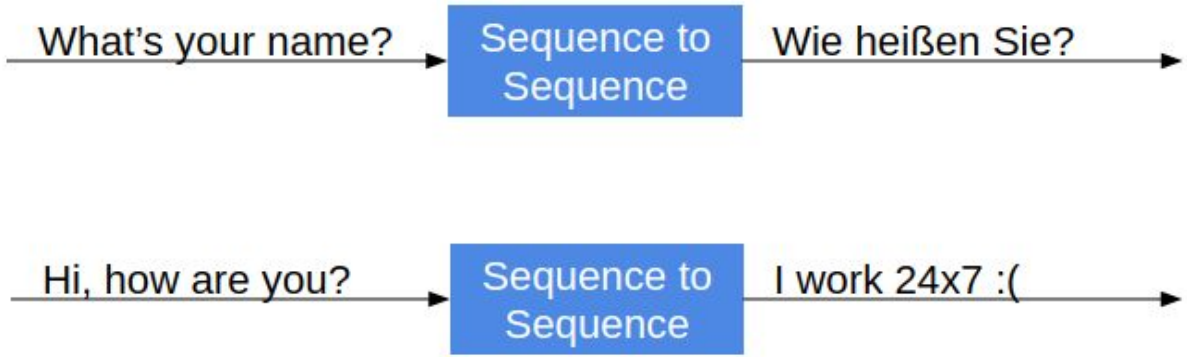
GloVe Embeddings

- Count based model
- Dimensionality reduction on co-occurrence counts matrix
- word-context matrix -> word-feature matrix
- Common Crawl
  - 840B tokens, 2.2M vocab, 300d vectors

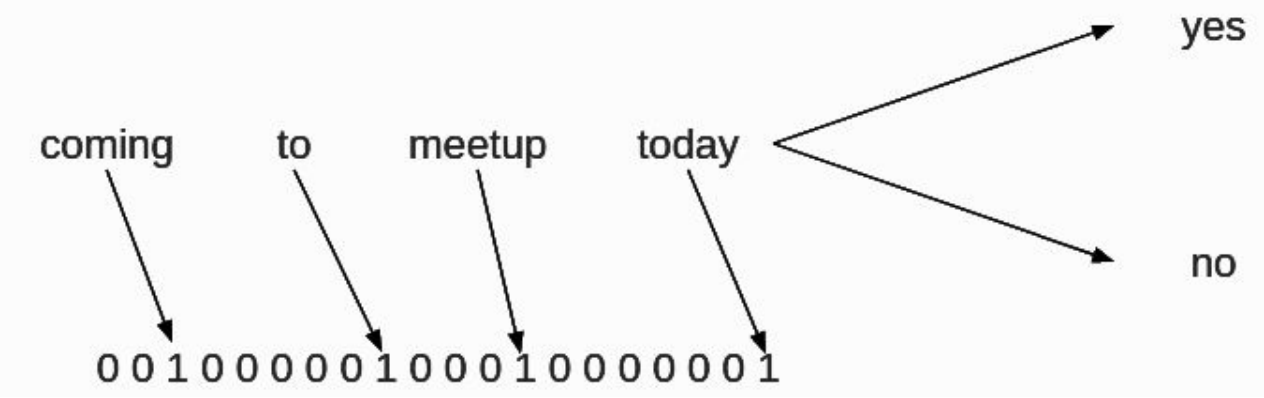
Jeffrey Pennington, Richard Socher, and Christopher D. Manning. 2014. GloVe: Global Vectors for Word Representation

Sequence to Sequence

- Convert sequence from one domain to another
  - English <> German
  - Question <> Answer

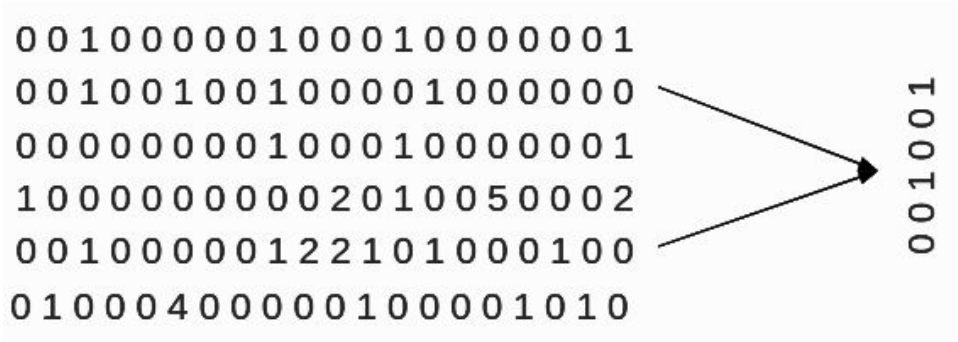


Sequence to Sequence



N - dimensions

Sequence to Sequence



Counts of the words in sentences

Target Variables: yes or no

TF-IDF

- TF(t) = Number of times a term t appears in a document / Total number of terms in the document
- IDF(t) = log(Total number of documents / Number of documents with term t in it)
- TF-IDF(t) = TF(t) * IDF(t)

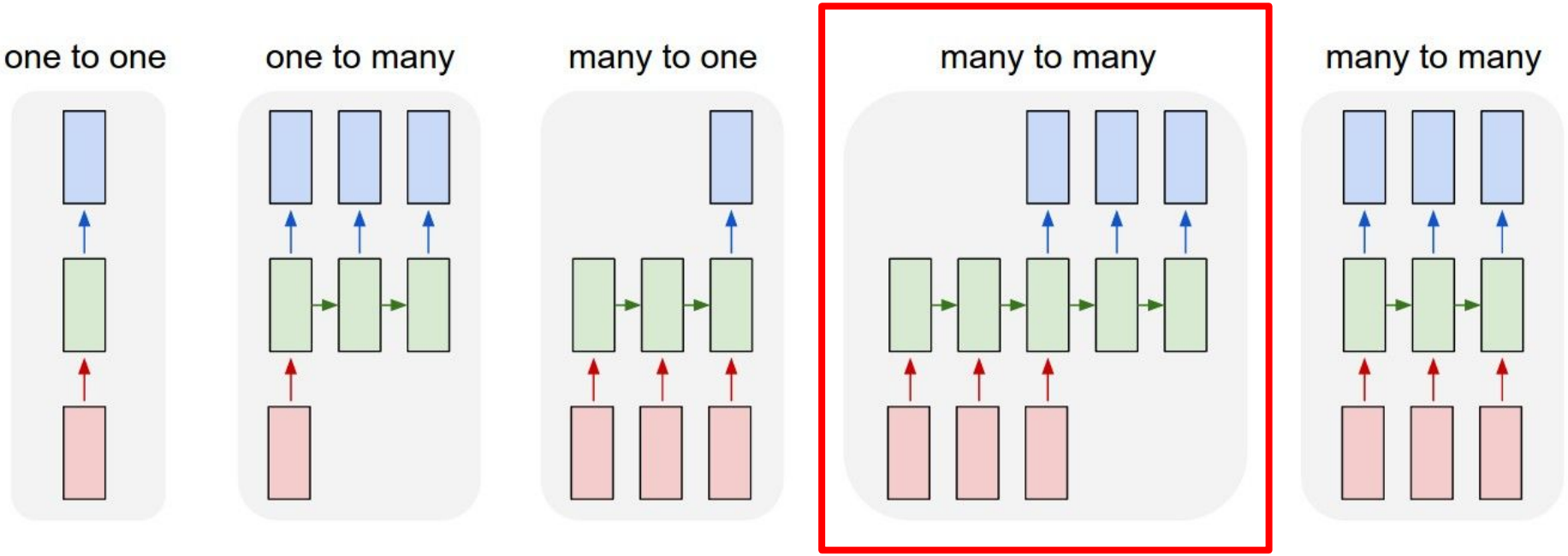
```
tfidf = TfidfVectorizer(min_df=3,  max_features=None,
            strip_accents='unicode', analyzer='word',token_pattern=r'\w{1,}',
            ngram_range=(1, 2), use_idf=1, smooth_idf=1, sublinear_tf=1,
            stop_words = 'english')
```

SVD

- Latent semantic analysis
- scikit-learn version of SVD
- 120 components

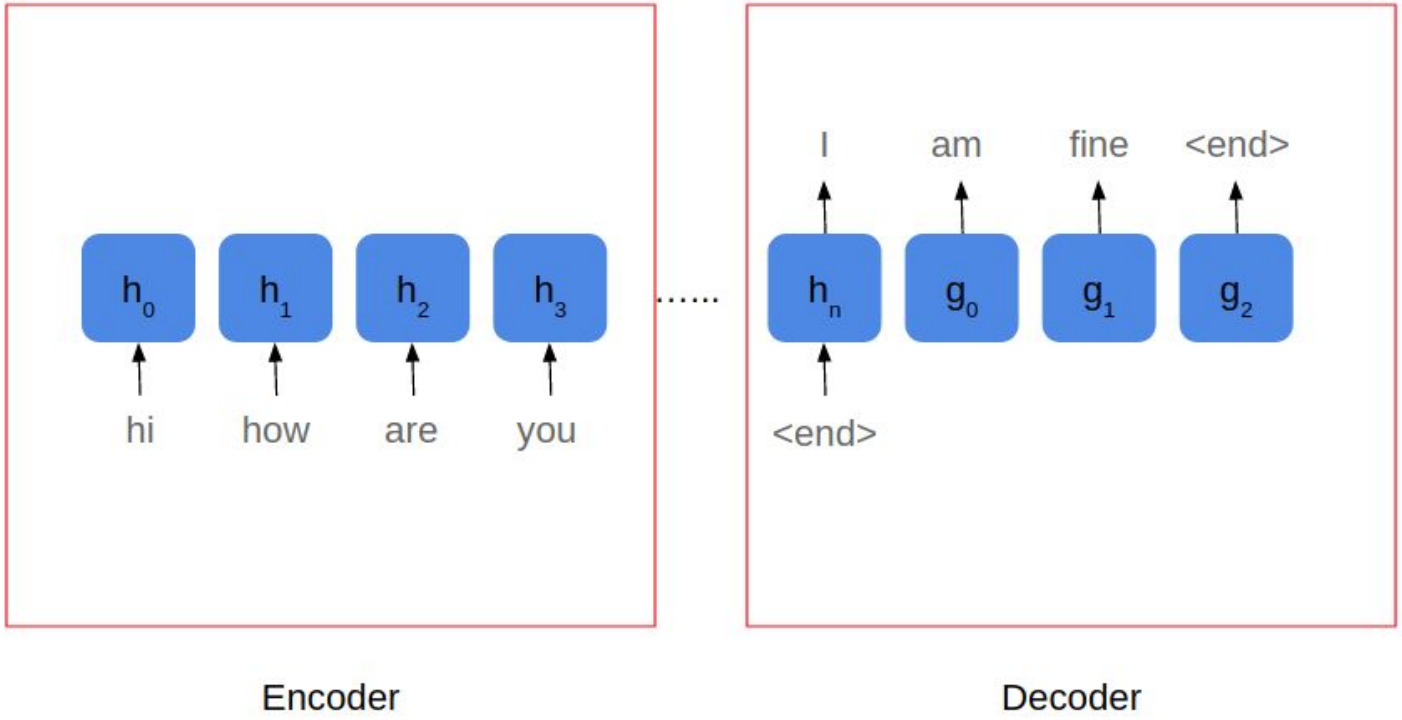
```
svd = decomposition.TruncatedSVD(n_components=120)
xtrain_svd = svd.fit_transform(xtrain)
xtest_svd = svd.transform(xtest)
```

Sequence to Sequence

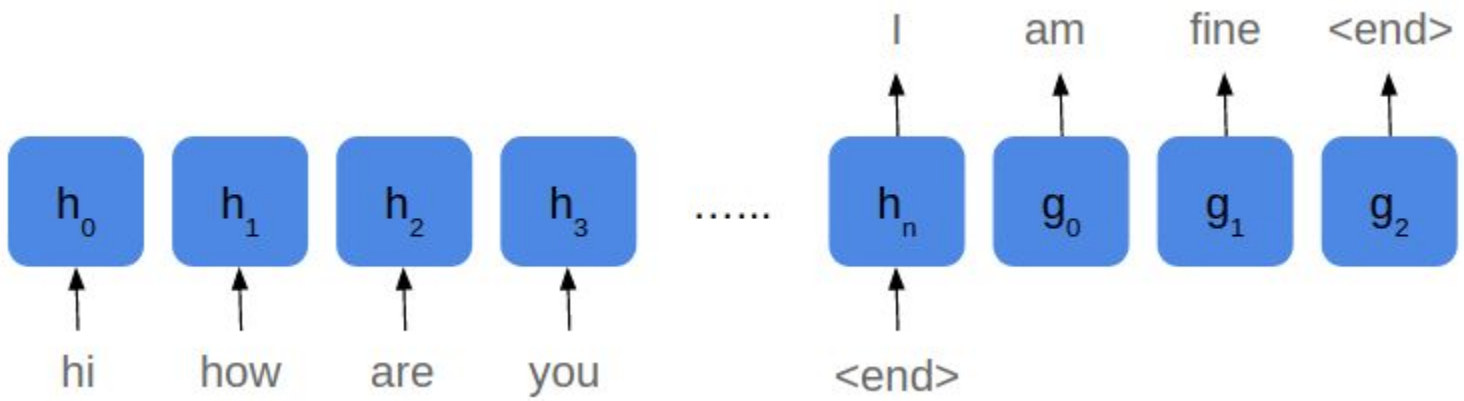


http://karpathy.github.io/2015/05/21/rnn-effectiveness/

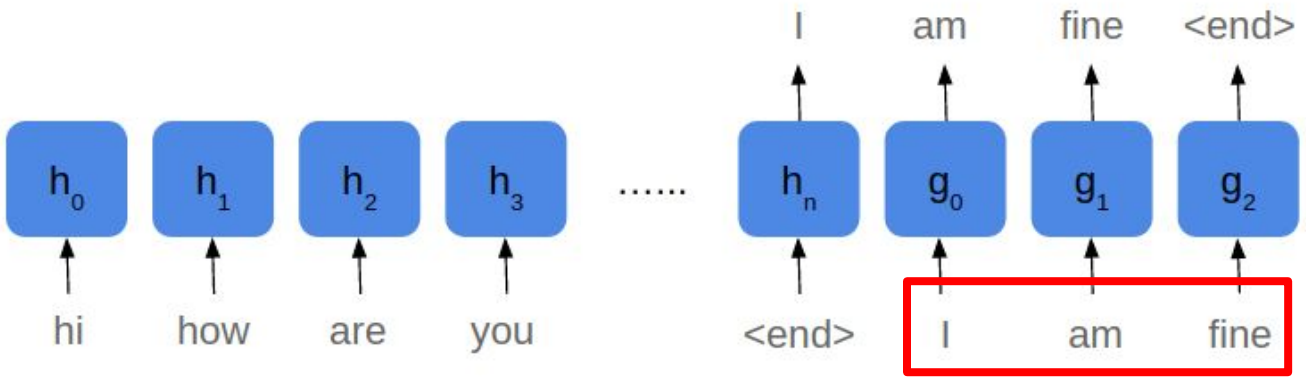
Sequence to Sequence



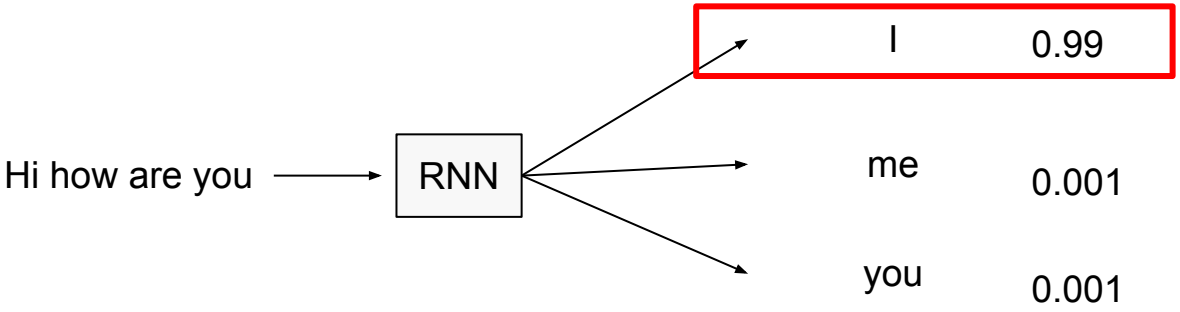
Sequence to Sequence



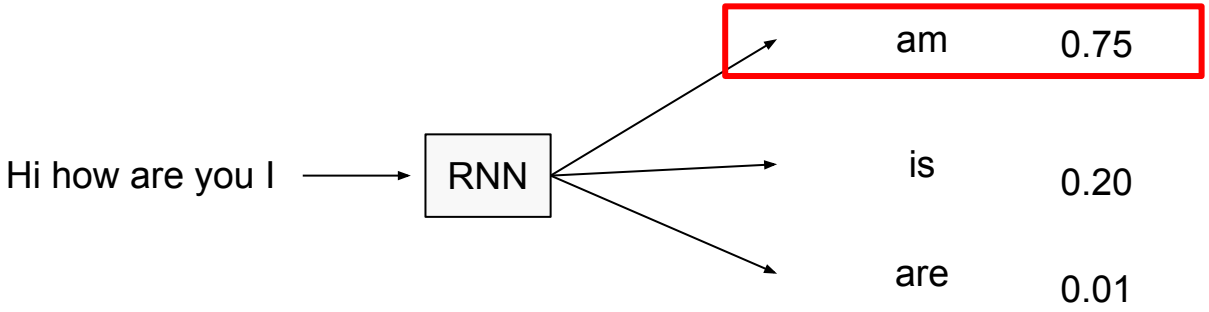
Sequence to Sequence



Predictions using Seq2Seq

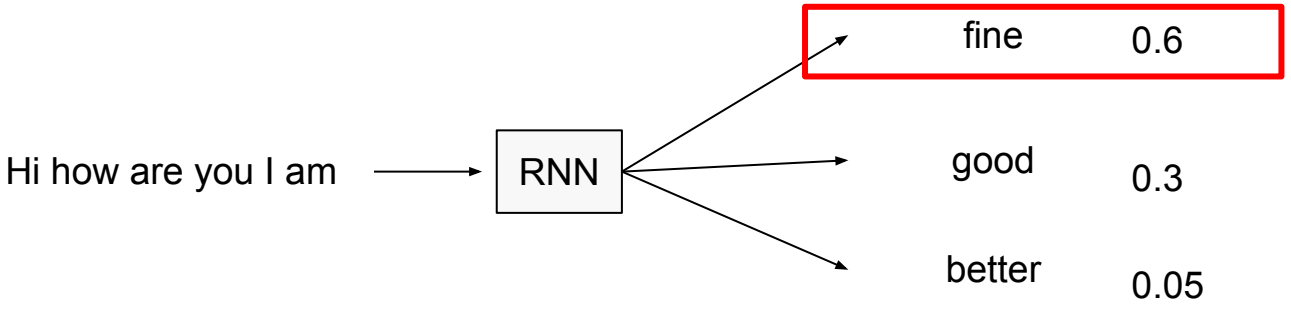


Predictions using Seq2Seq

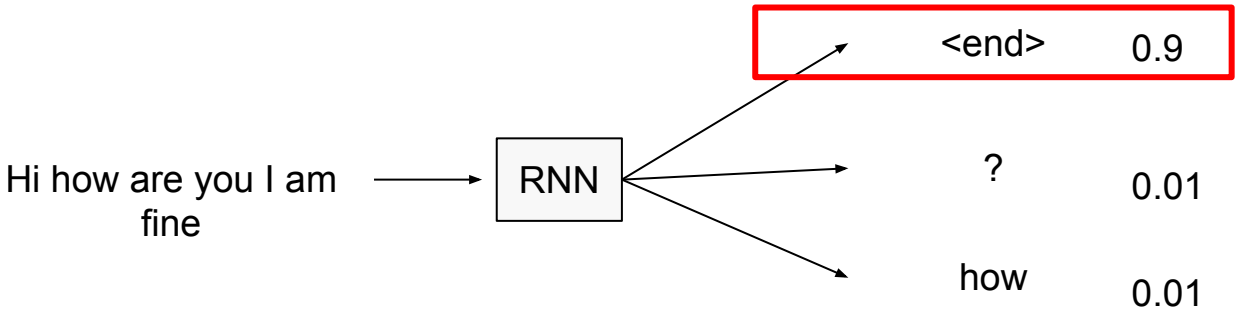


Top 3 Predictions

Predictions using Seq2Seq

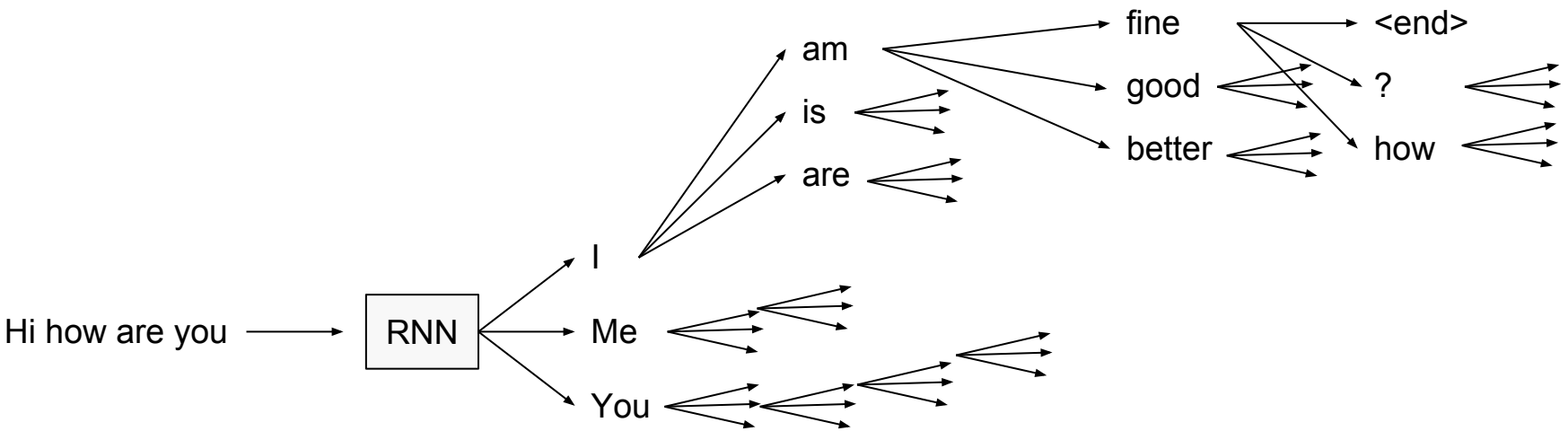


Predictions using Seq2Seq



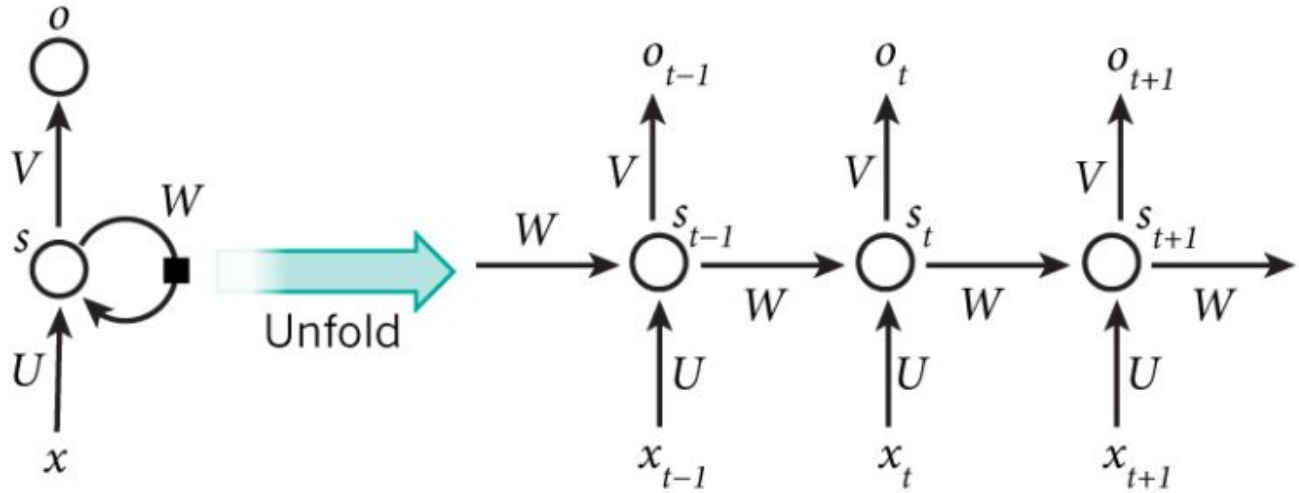
Top 3 Predictions

Predictions using Seq2Seq



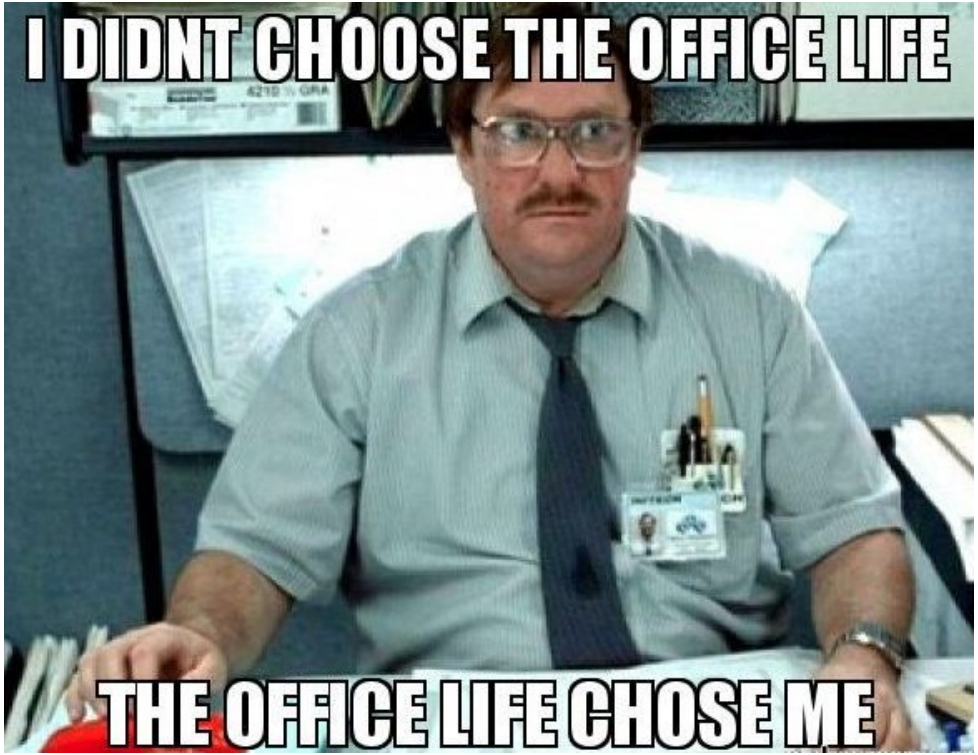
But what are RNNs?

- Sequential information
- Output dependent on previous input



A recurrent neural network and the unfolding in time of the computation involved in its forward computation. Source: Nature

But what are RNNs?



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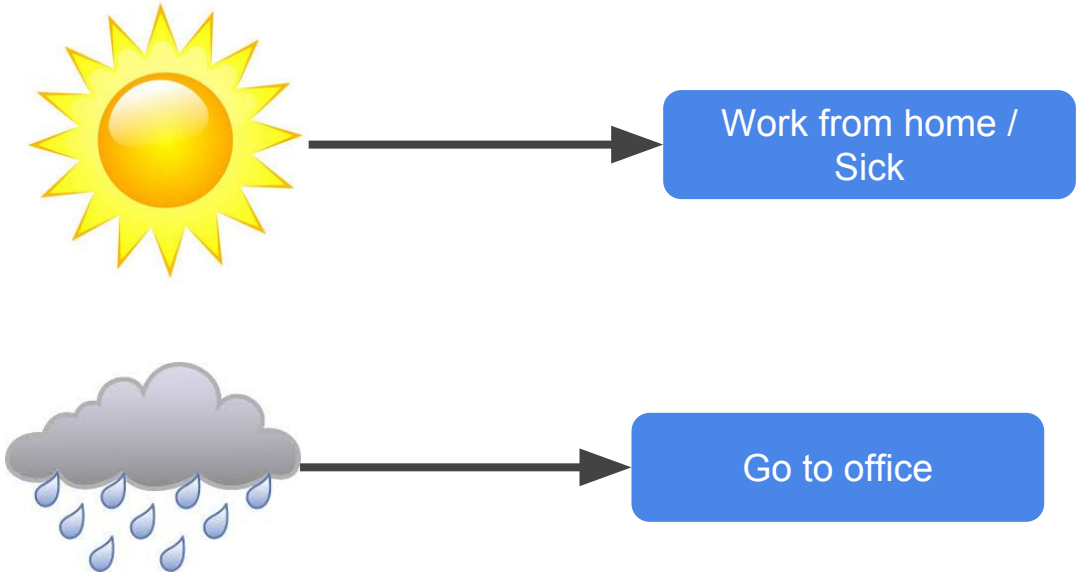
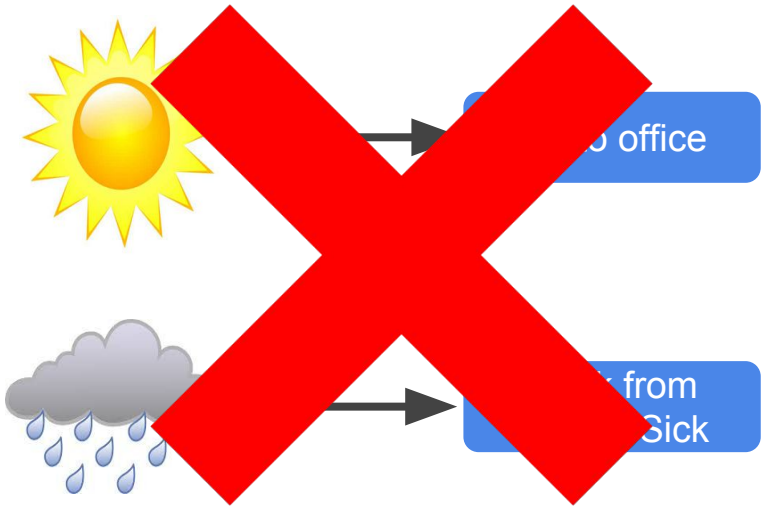


- A simple neural network depending on the weather.
- If it's sunny, I work from home.
- Bad weather implies going to the office.

But what are RNNs?



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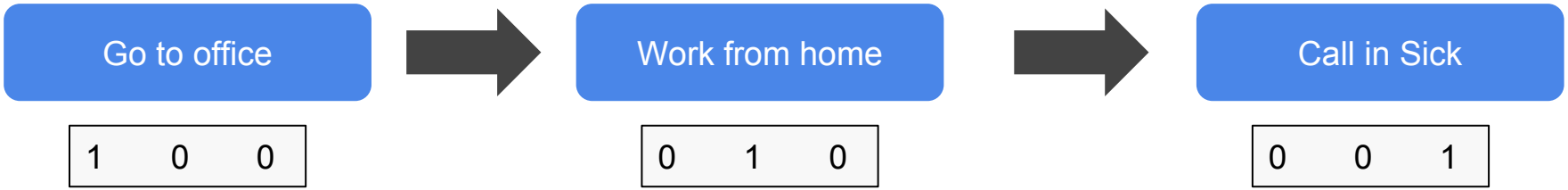

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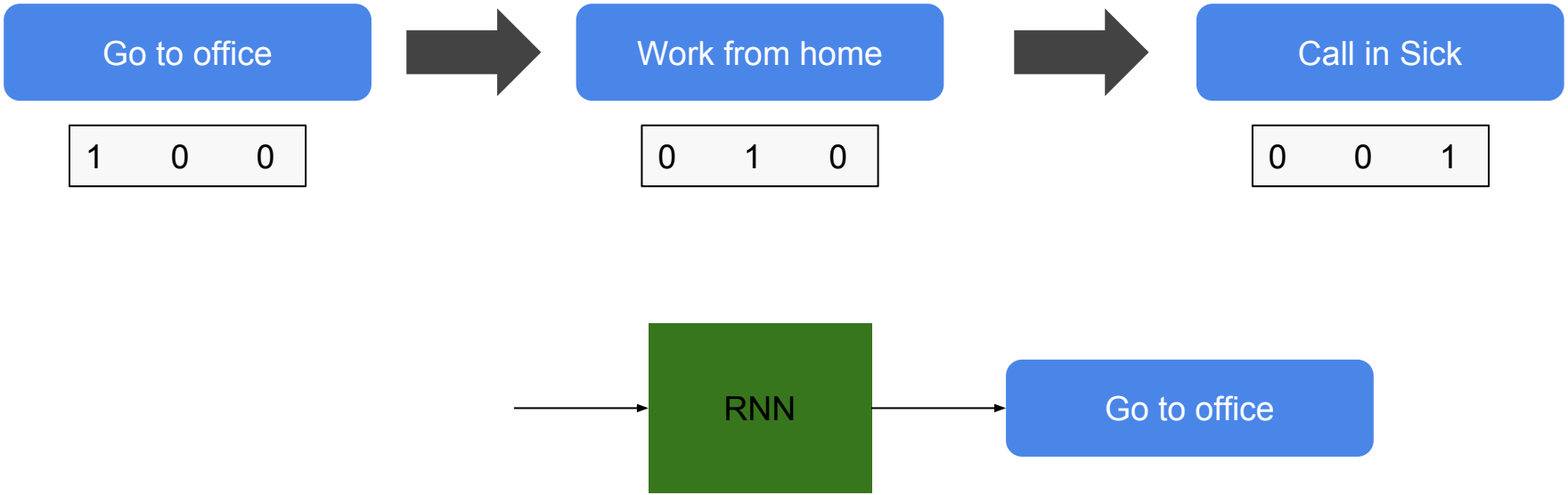

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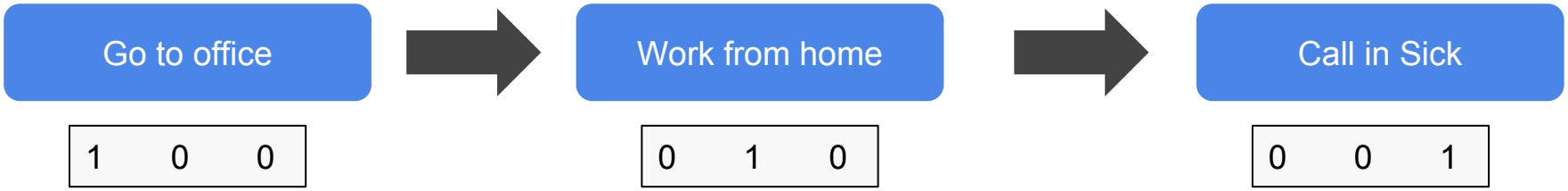

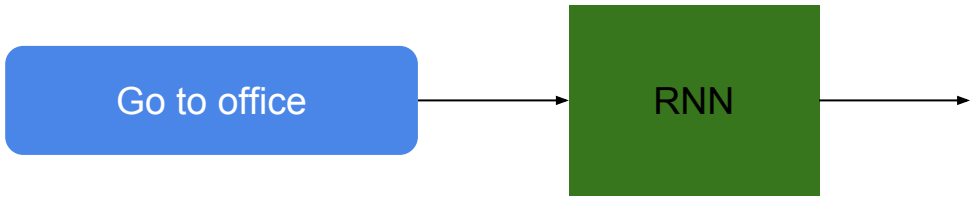

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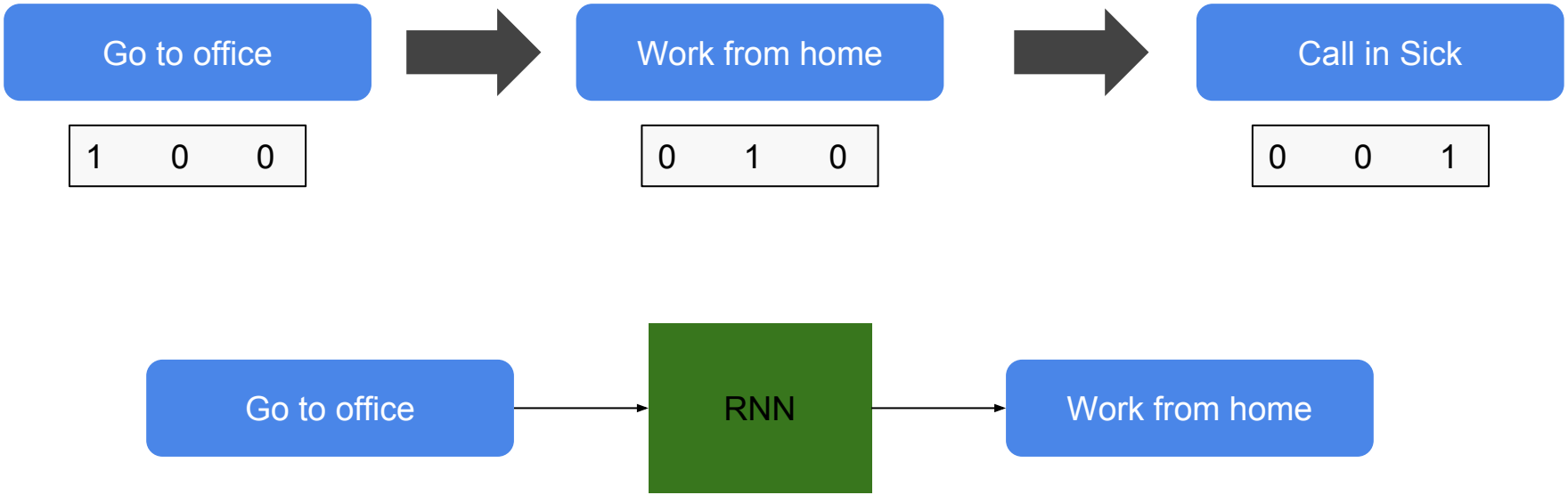

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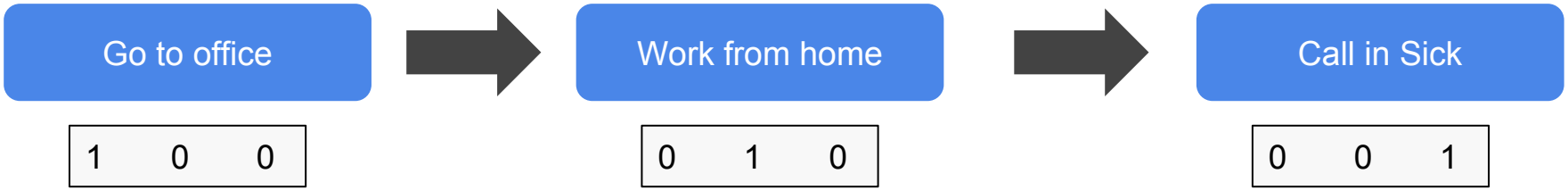

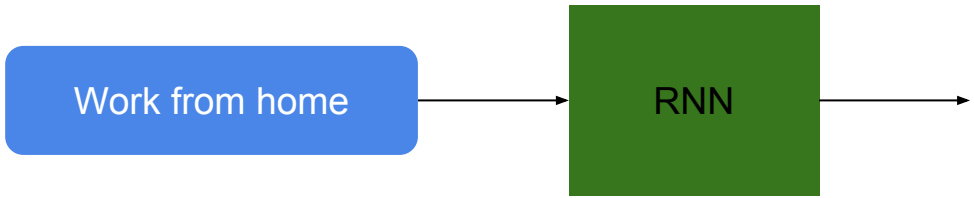

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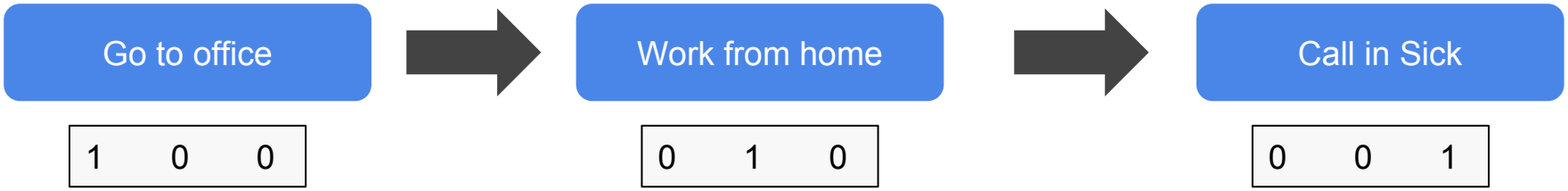

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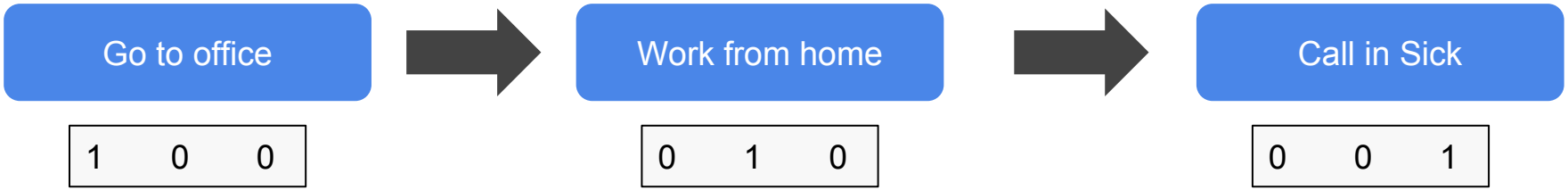

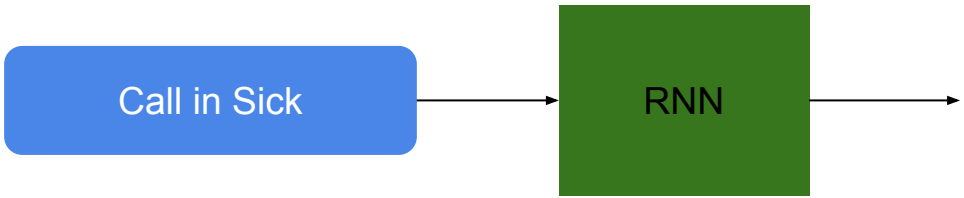

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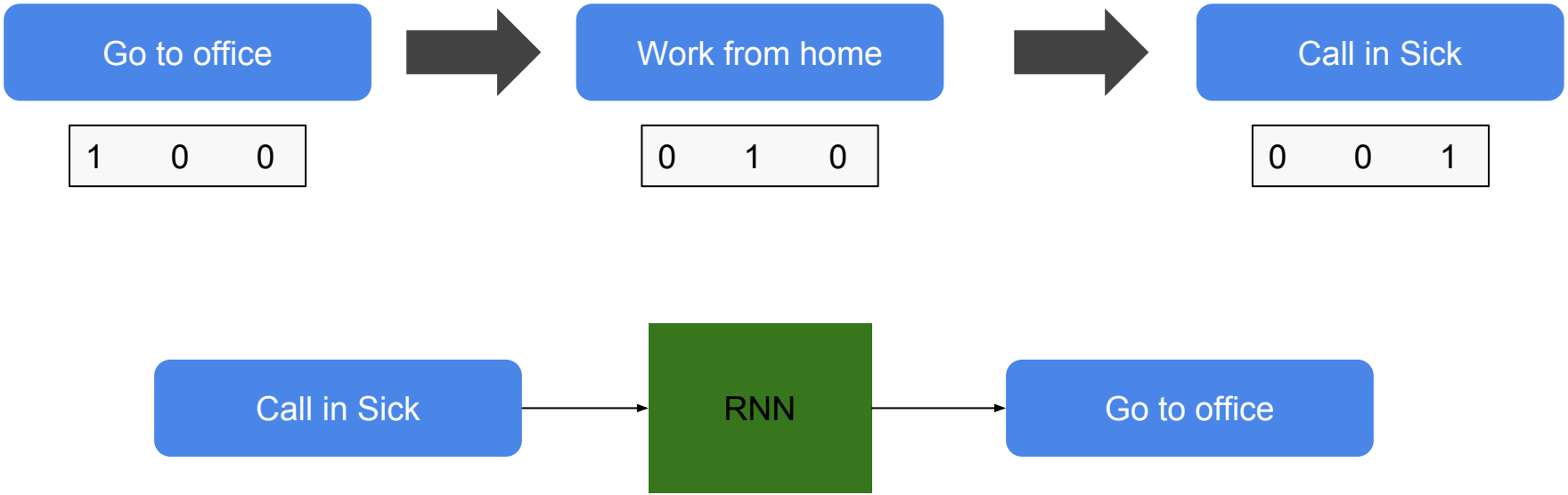

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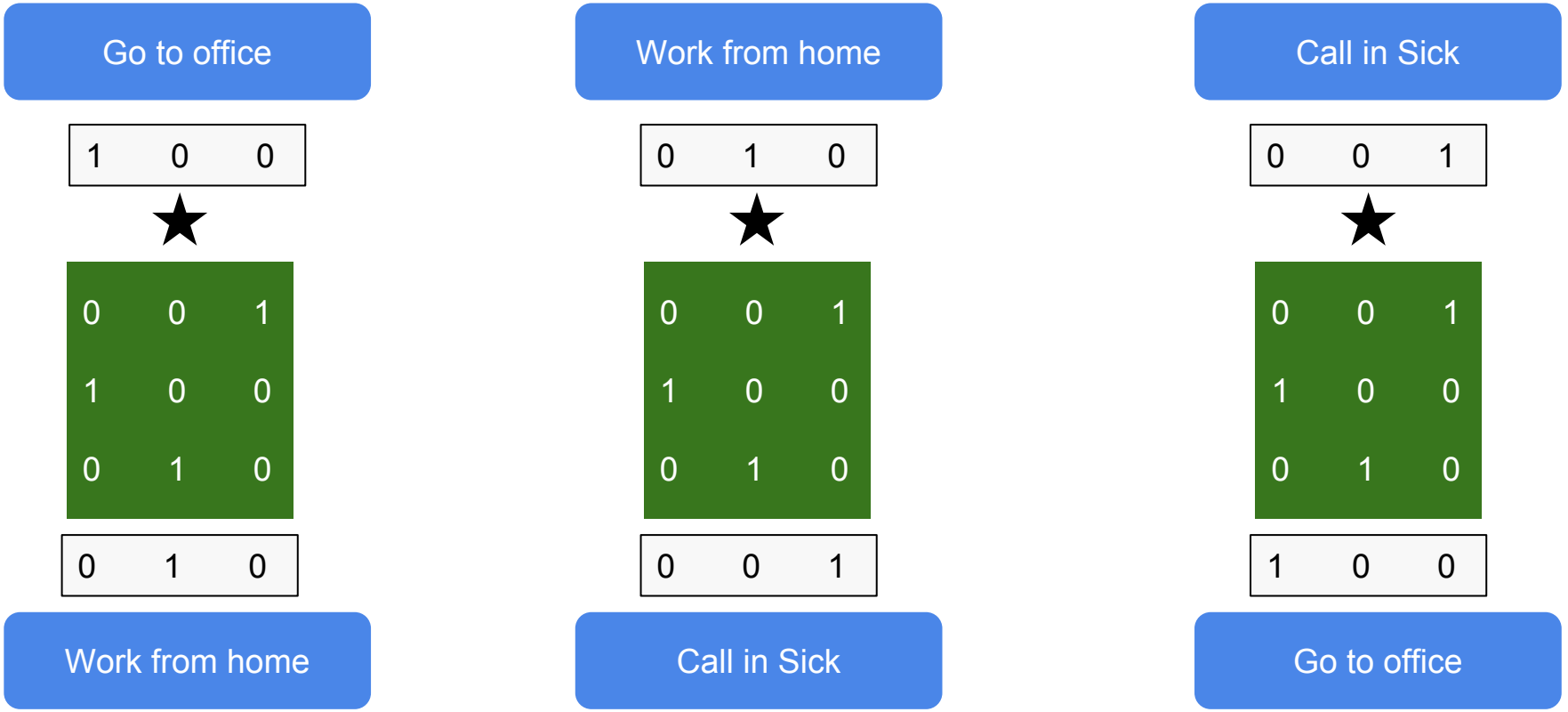

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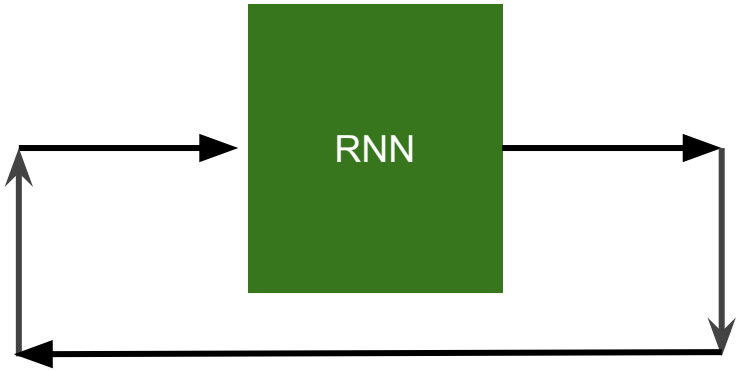
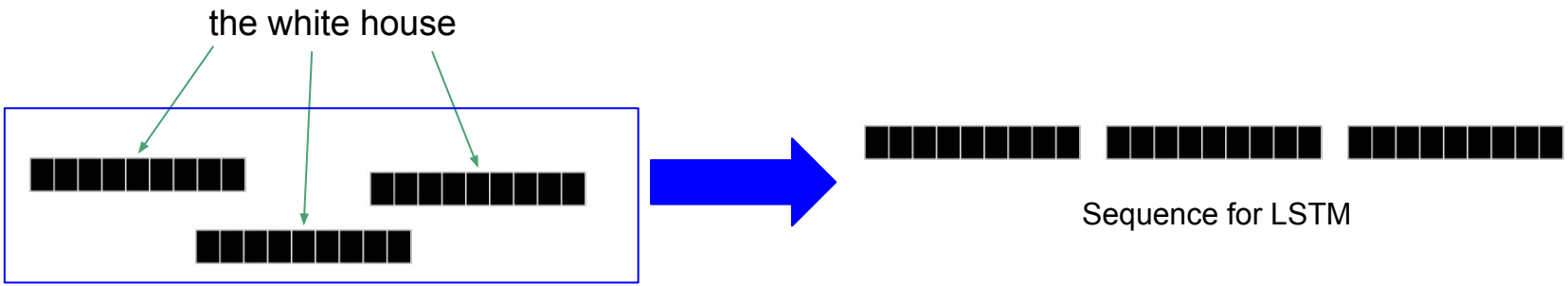


LSTM

- Long short term memory
- A type of RNN
- Learn long term dependencies
- Used two LSTM layers

Feeding Data To LSTMs




```
model = Sequential()
model.add(LSTM(512, return_sequences=True, input_shape=(len(self.X[0]), len(self.X[0][0]))))
model.add(Dropout(0.2))
model.add(LSTM(128, return_sequences=True))
model.add(Dropout(0.2))
model.add(LSTM(64, return_sequences=False))
model.add(Dropout(0.2))
model.add(Dense(1000,activity_regularizer=activity_l2(0.01)))
model.add(Dense(len(self.nd.categories),activity_regularizer=activity_l2(0.01)))
model.add(Activation('sigmoid'))

model.compile(loss='binary_crossentropy', optimizer='adam')
```

- United States
- President
- Politician
- Washington
- Lawyer
- Secretary

Embedding Layers

- Simple layer
- Converts indexes to vectors
- [[4], [20]] -> [[0.25, 0.1], [0.6, -0.2]]

1-D CNNs

- One dimensional convolutional layer
- Temporal convolution
- Simple to implement:

```
for i in range(sample_length):
    y[i] = 0
    for j in range(kernel_length):
        y[i] += x[i-j] * h[j]
```

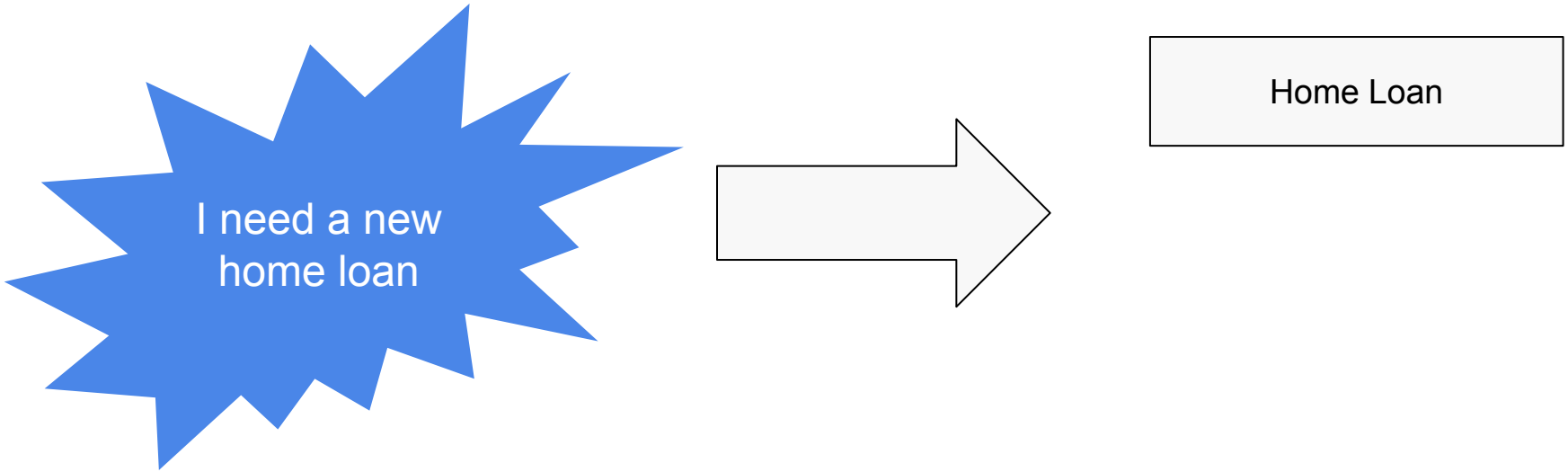
Training a Simple RNN

Hi.	Grüß Gott!
Run!	Lauf!
Wow!	Potzdonner!
Wow!	Donnerwetter!
Fire!	Feuer!
Help!	Hilfe!
Help!	Zu Hülf!
Stop!	Stopp!
Wait!	Warte!
Hello!	Hallo!
I try.	Ich probiere es.
I won!	Ich hab gewonnen!
I won!	Ich habe gewonnen!

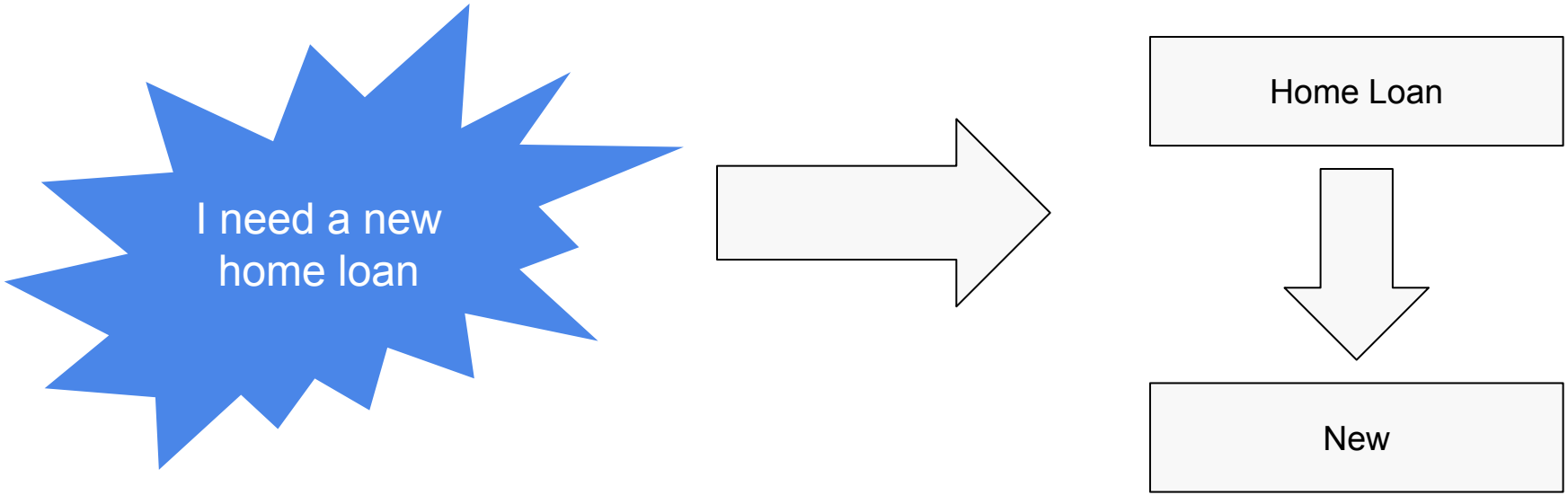
Intention Based Chatbots

- Every “chat” has an intent
- RNNs without seq2seq
- Multi class classification problem
- Isn’t as easy as it sounds!

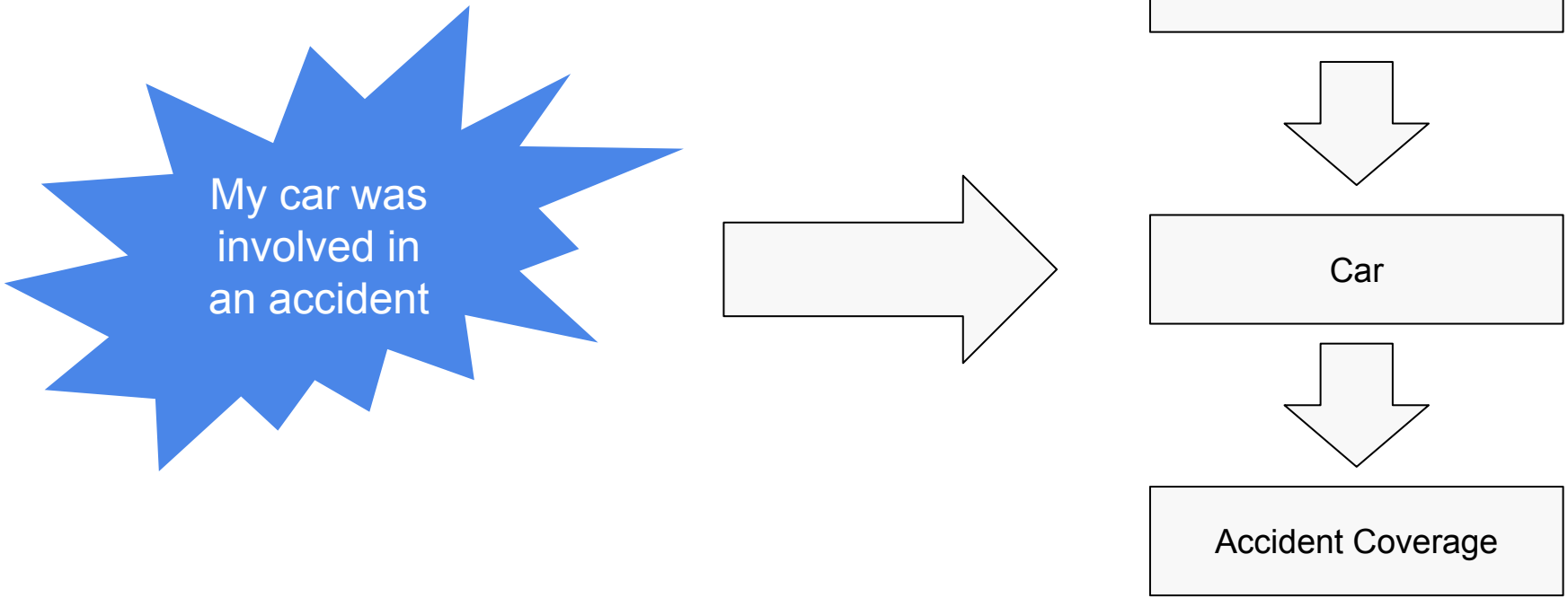
Intention Based Chatbots



Intention Based Chatbots



Intention Based Chatbots

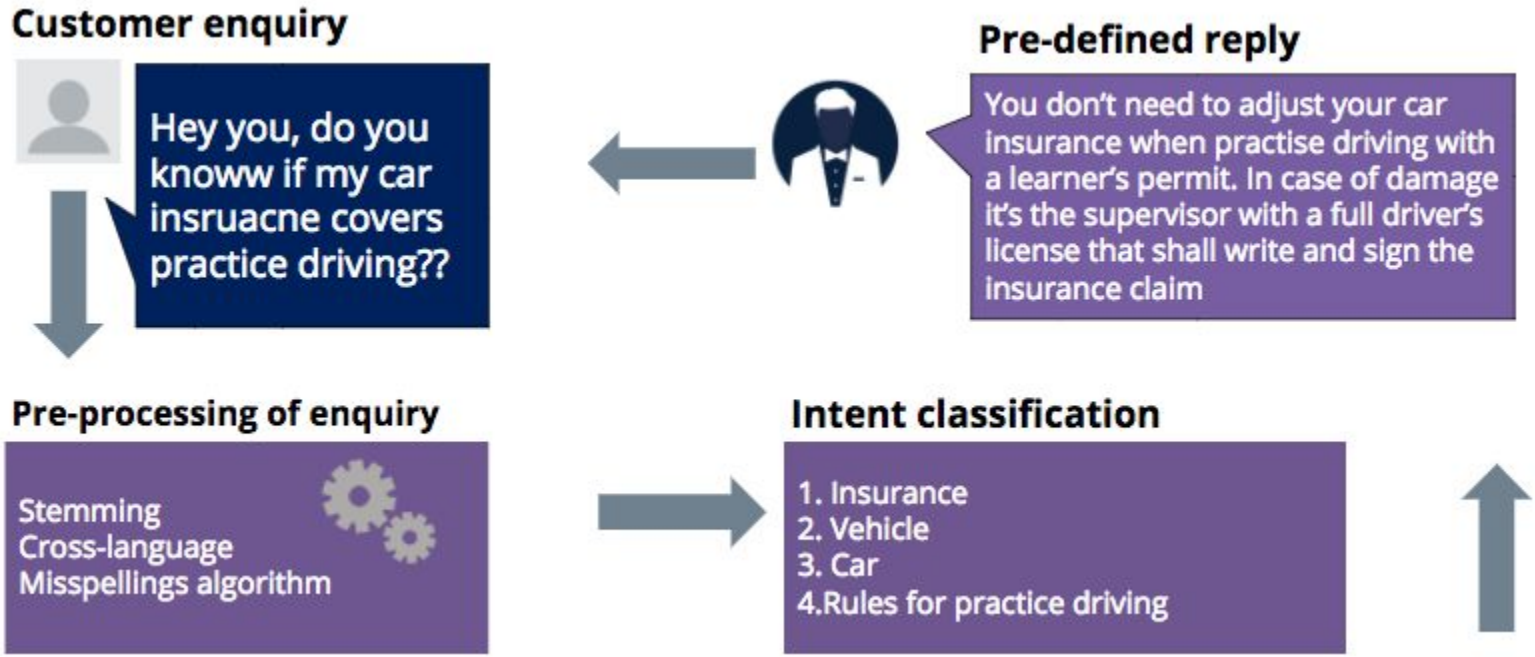


Intention Based Chatbots

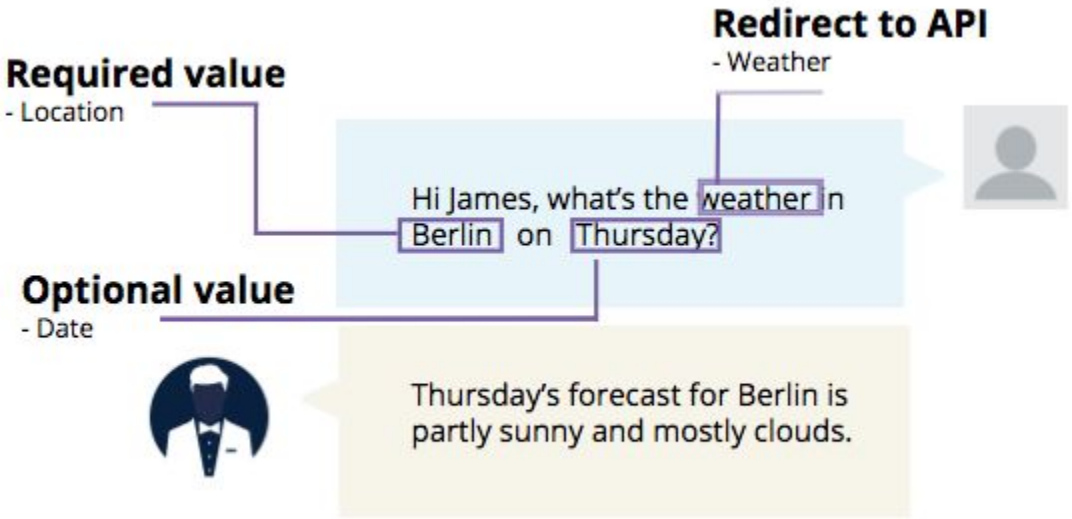
Credit Card Application

Child Insurance

Intention Based Chatbots



Intention Based Chatbots



Thank you

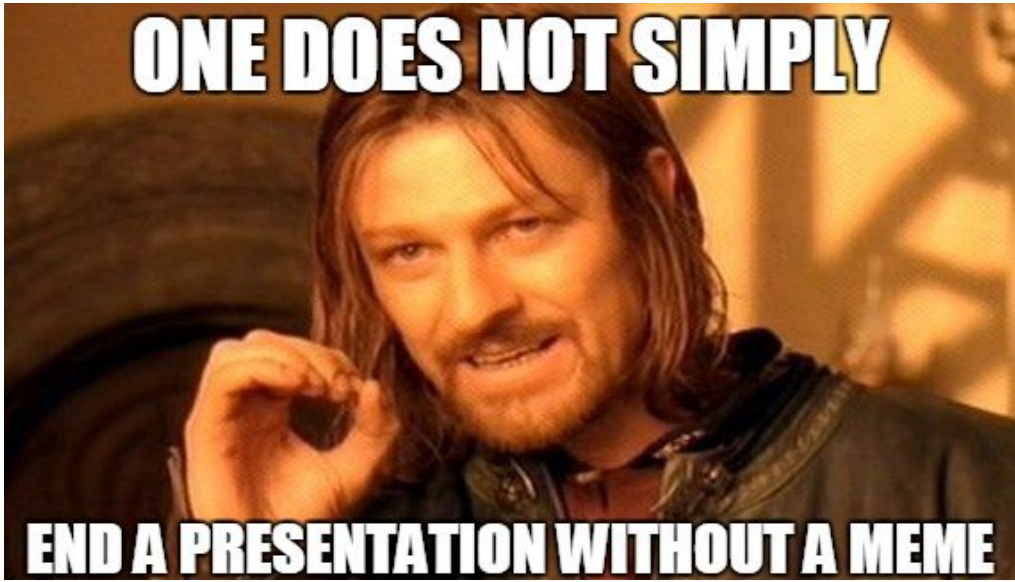
Questions / Comments?

A Lot of Code:

- ❖ github.com/abhishekkrthakur

Get in touch:

- ➢ E-mail: abhishek4@gmail.com
- ➢ LinkedIn: bit.ly/thakurabhishek
- ➢ Kaggle: kaggle.com/abhishek
- ➢ Twitter: @abhi1thakur



If everything fails, use Xgboost