

Recurrent Neural Networks

FinTech
Lesson 14.3

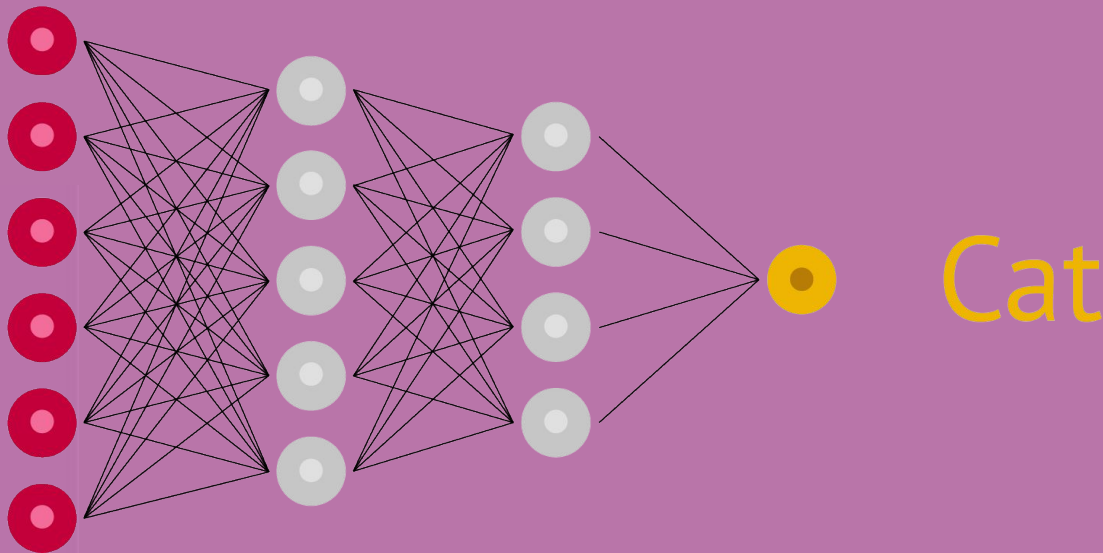


Introducing Recurrent Neural Networks (RNNs)

RNNs are able to remember the past and their decisions are influenced by what it has learned from the past.



(Animated Cat)





What Are Recurrent Neural Networks Used For?

Introducing Recurrent Neural Networks (RNNs)

What are recurrent neural networks used for?

01

Natural Language Processing (NLP)

02

DNA sequences

03

Time series data

04

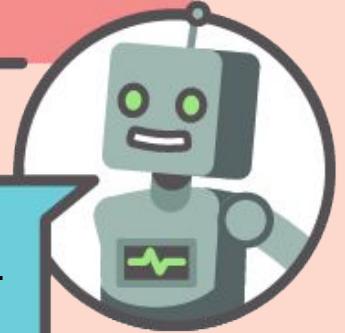
Music composition

What Are Recurrent Neural Networks Used For?

Natural Language Processing (NLP)

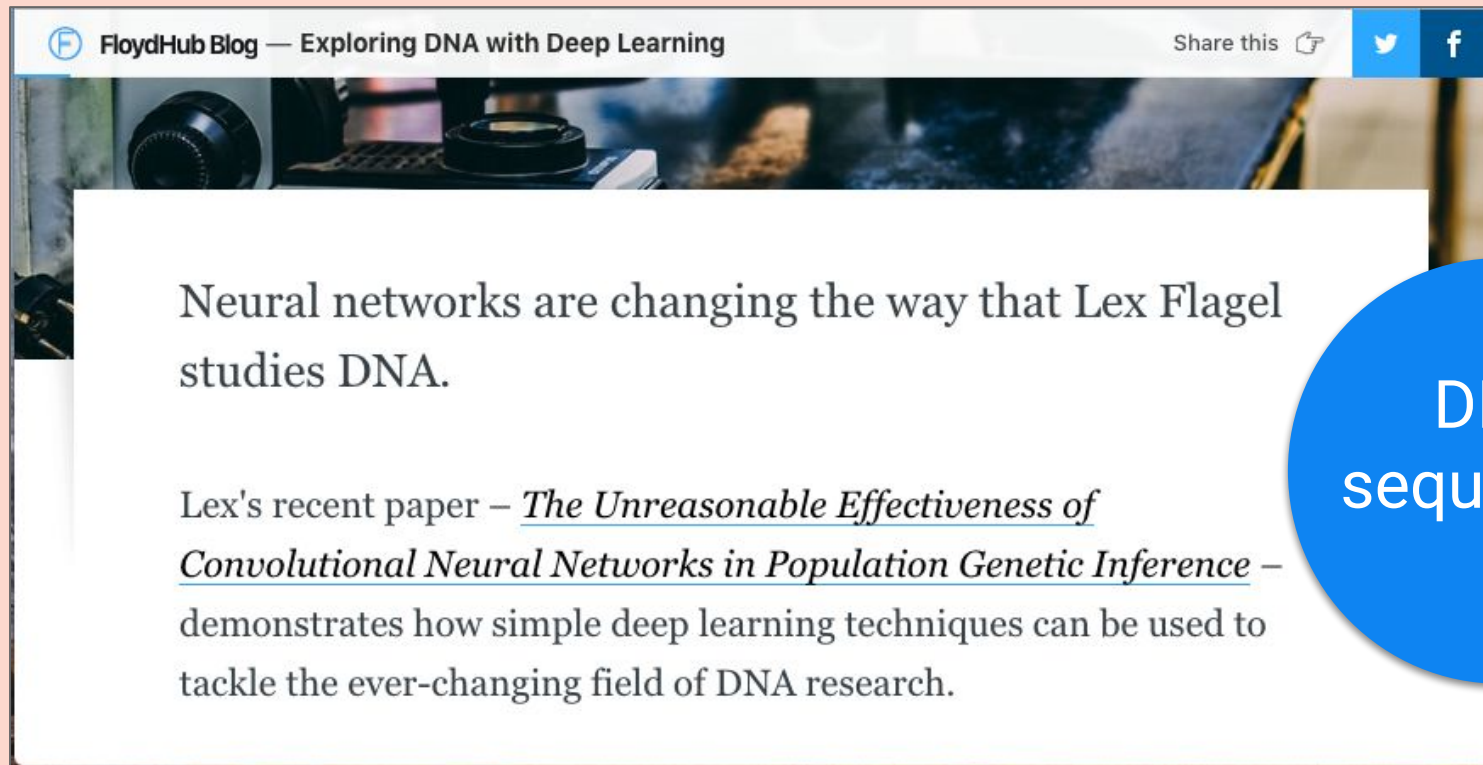


Send \$50 to Allison to be delivered today from my checking account.



I understand, Tom. I'd be happy to help you with that.

What Are Recurrent Neural Networks Used For?



FloydHub Blog — Exploring DNA with Deep Learning

Share this

Neural networks are changing the way that Lex Flagel studies DNA.

Lex's recent paper – *The Unreasonable Effectiveness of Convolutional Neural Networks in Population Genetic Inference* – demonstrates how simple deep learning techniques can be used to tackle the ever-changing field of DNA research.

DNA sequences

What Are Recurrent Neural Networks Used For?

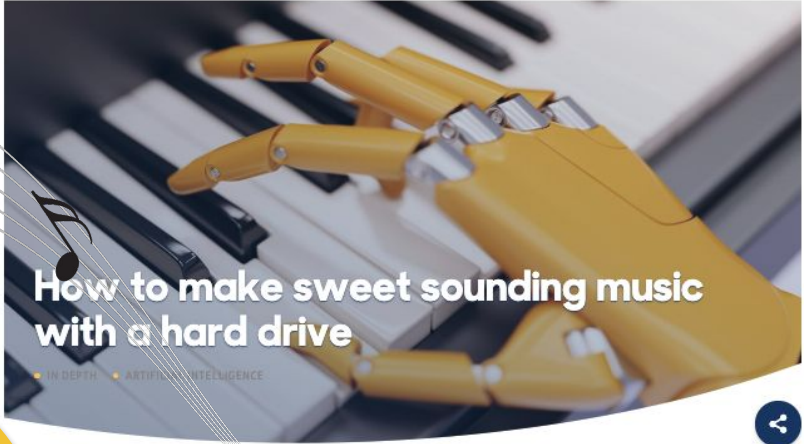


Music
Composition

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How to make sweet sounding music with a hard drive

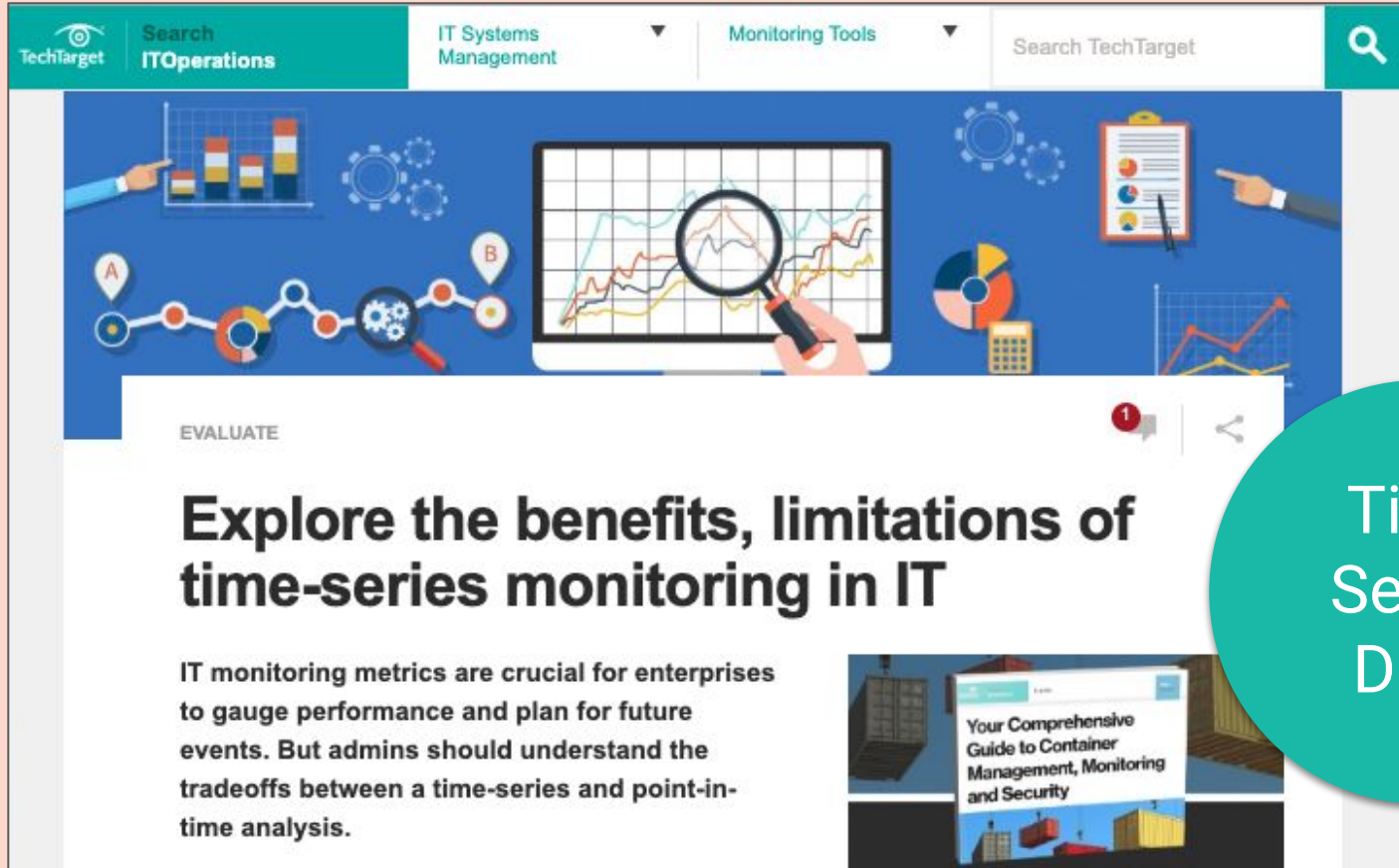
IN DEPTH ARTIFICIAL INTELLIGENCE

Artificial intelligence is being used by musicians to help compose melodies, write lyrics and even perform. It may only be a matter of time before a computer has a number one hit.

By Sarah Griffiths
17th December 2018

Asked how The Beatles approached songwriting, John Lennon quipped "on the M1 (motorway) – turn right, past London." His songwriting partner, Paul McCartney described the process as more of a **long and winding road**, in which the pair looked for chord shapes and then worked out a melody as if they were "doing a crossword puzzle".

What Are Recurrent Neural Networks Used For?



The image is a screenshot of a TechTarget article. The header includes the TechTarget logo, a search bar, and navigation links for 'IT Systems Management' and 'Monitoring Tools'. The article title is 'Explore the benefits, limitations of time-series monitoring in IT'. The sub-header is 'EVALUATE'. The main text states: 'IT monitoring metrics are crucial for enterprises to gauge performance and plan for future events. But admins should understand the tradeoffs between a time-series and point-in-time analysis.' There is a red notification bubble with the number '1' and a share icon. A teal circle on the right contains the text 'Time Series Data'. At the bottom right, there is a thumbnail for another article titled 'Your Comprehensive Guide to Container Management, Monitoring and Security'.

TechTarget Search ITOperations IT Systems Management Monitoring Tools Search TechTarget

EVALUATE

Explore the benefits, limitations of time-series monitoring in IT

IT monitoring metrics are crucial for enterprises to gauge performance and plan for future events. But admins should understand the tradeoffs between a time-series and point-in-time analysis.

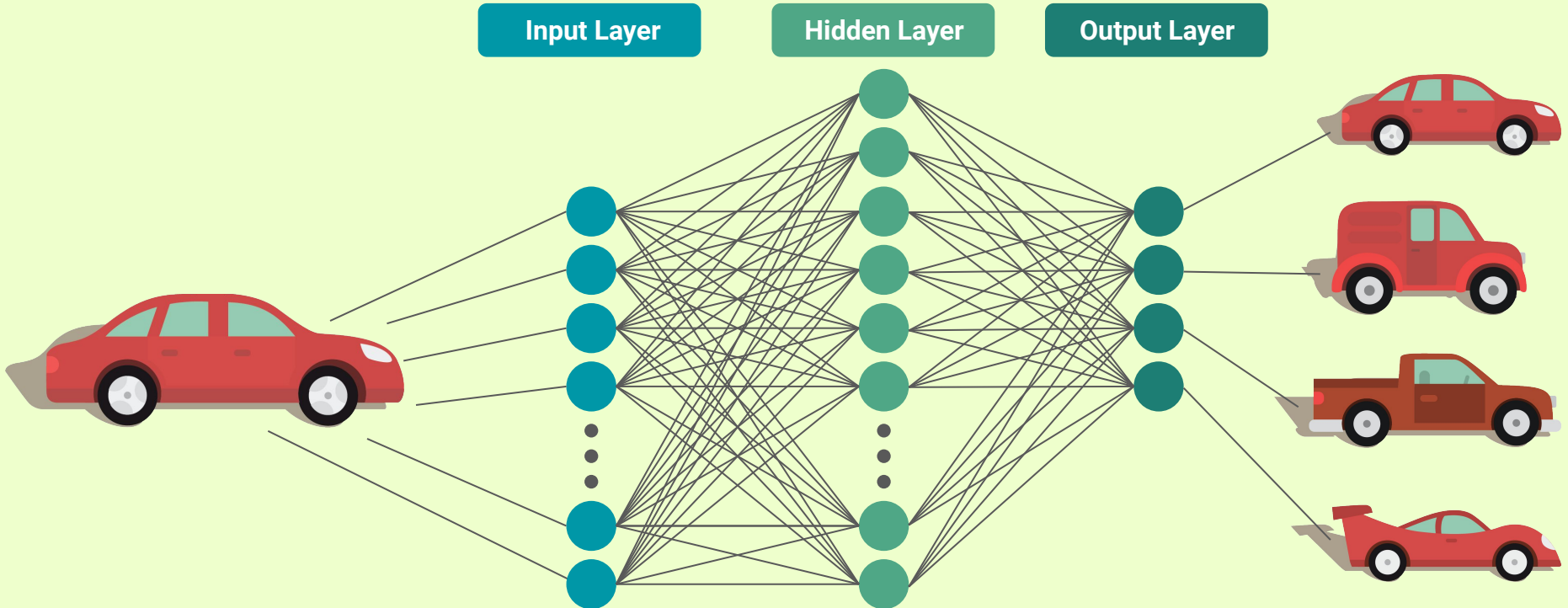
1

Your Comprehensive Guide to Container Management, Monitoring and Security

ANNs Vs. RNNs

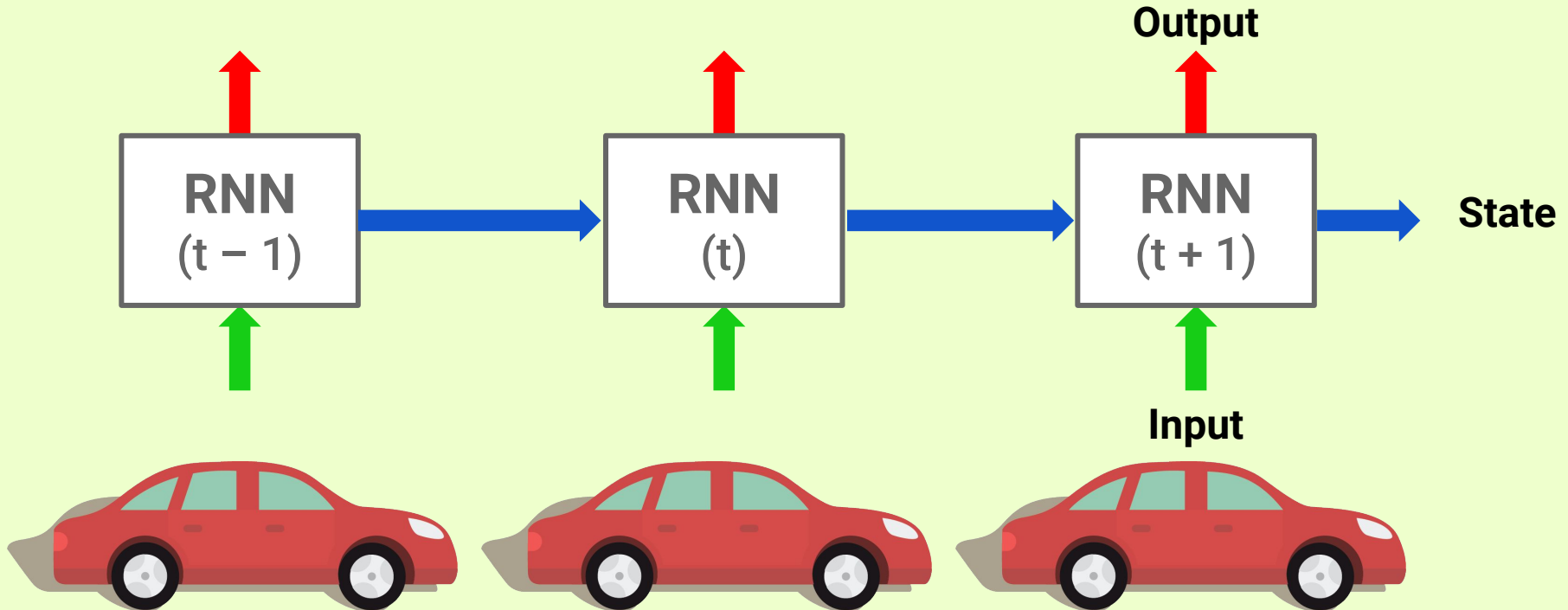
ANNs Vs. RNNs

We can use ANNs to identify the type of car from a still image.
However, can we predict the direction of a car in movement?



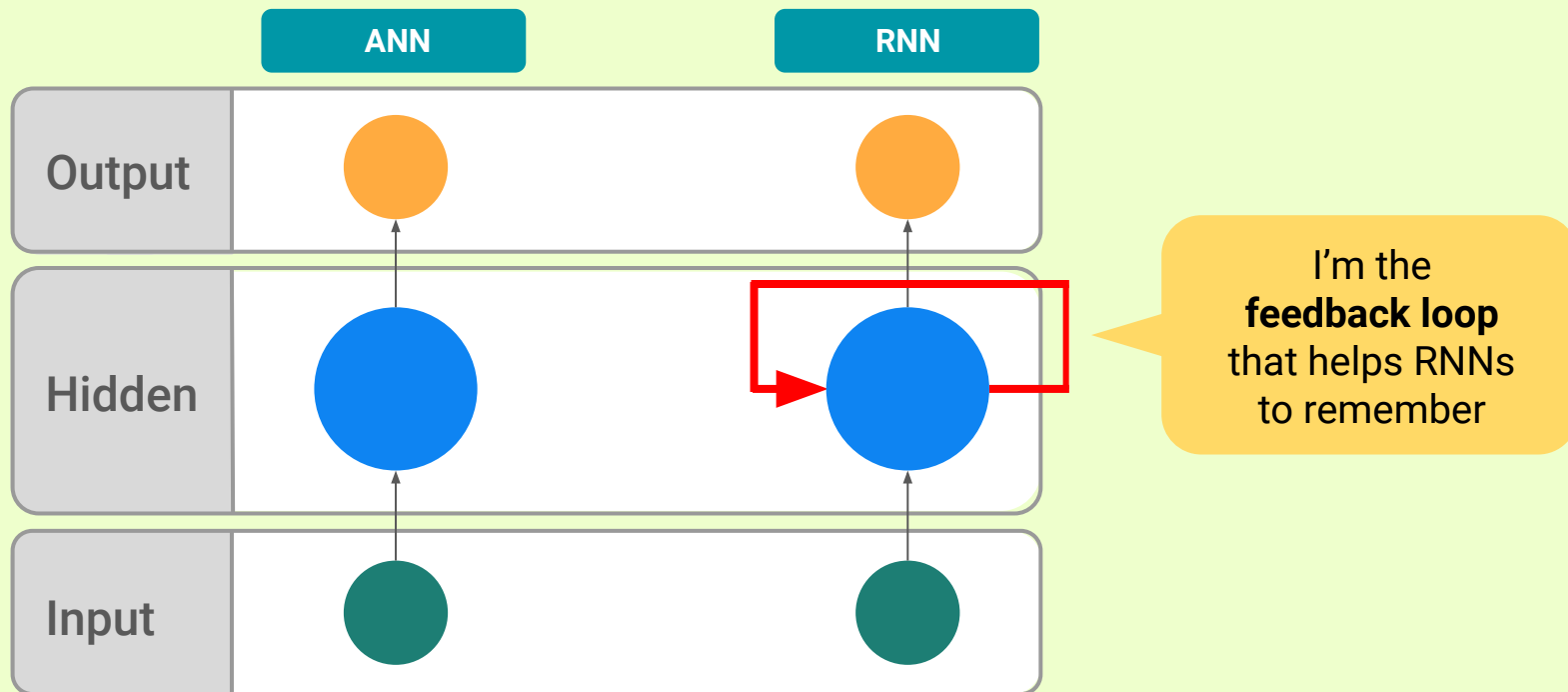
ANNs Vs. RNNs

RNNs are good at modeling sequence data thanks to their *sequential memory*. Using RNNs we can predict that the car is moving to the right.



ANNs Vs. RNNs

RNNs are good at modeling sequence data thanks to their *sequential memory*. Using RNNs we can predict that the car is moving to the right.

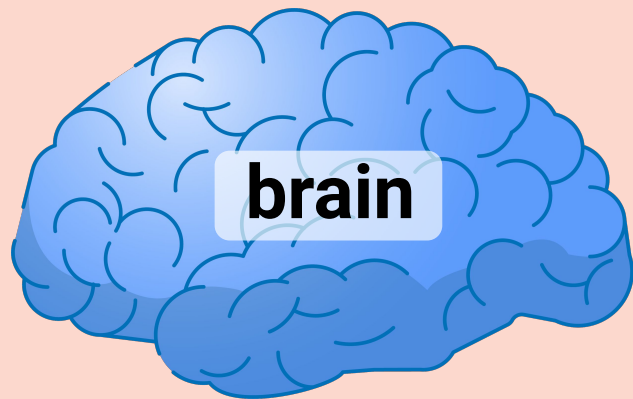




How Do RNNs Work?

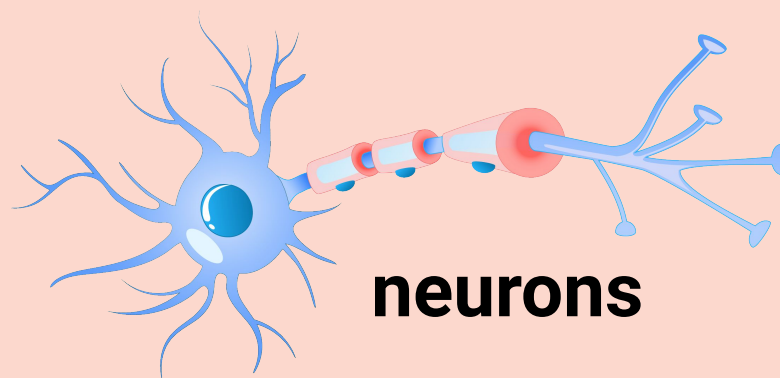
How RNNs Work

When you read this
sentence, your



is able to decode it
and understand ...

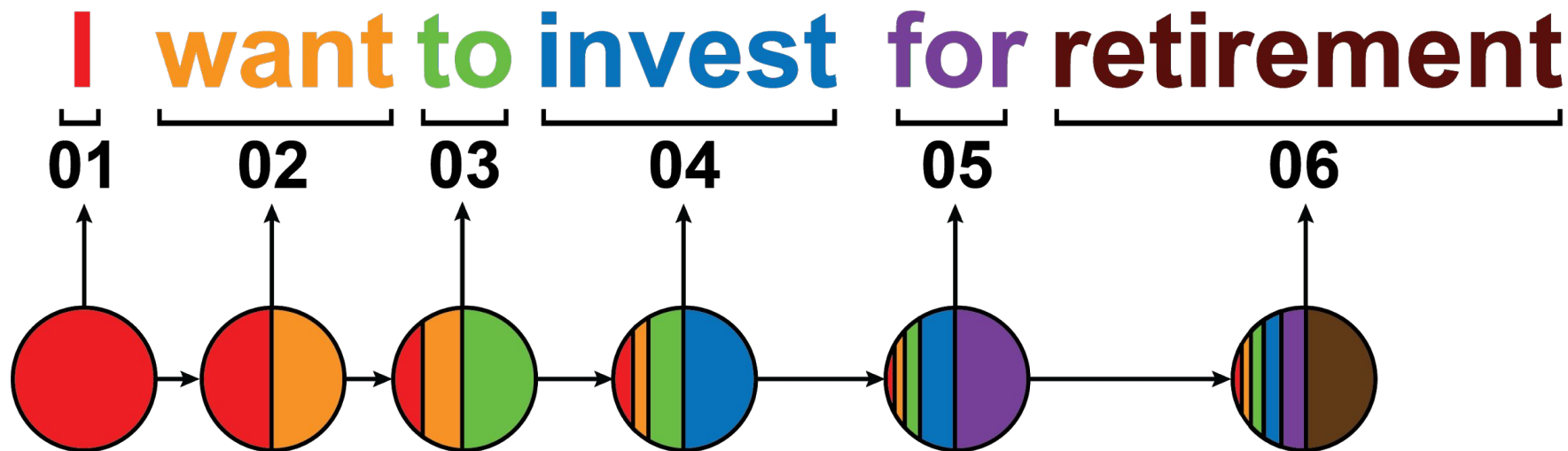
... because our



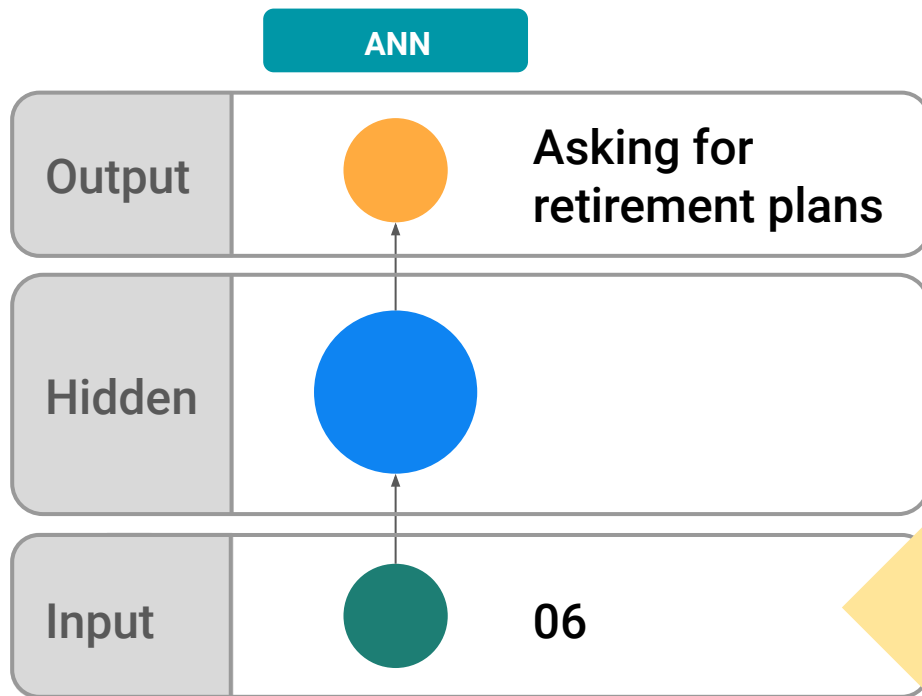
have memory
like RNNs.

How RNNs Work

The sentence is split into individual words. RNNs work sequentially so we feed it one word at a time. By the final step the RNN has encoded information from all the words in previous steps.



How RNNs Work

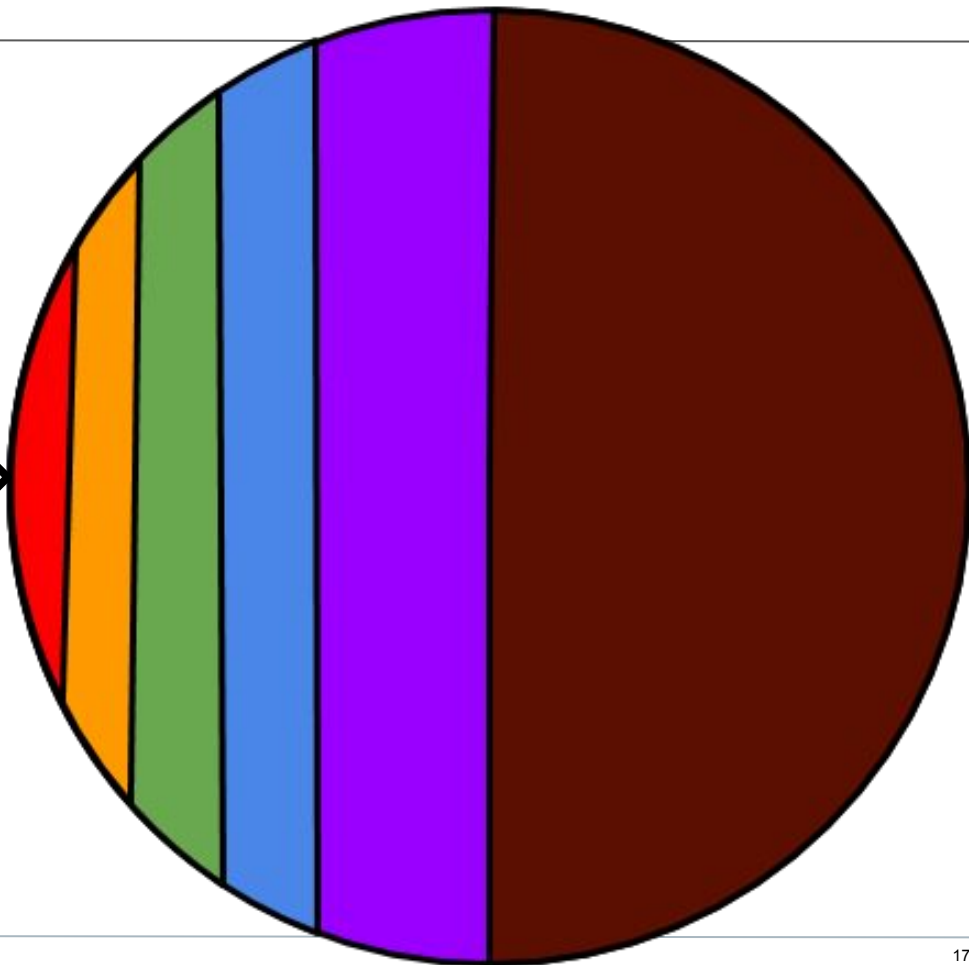


The final output (06) was created from the rest of the sequence, to predict what the phrase means, we take the final output and pass it to the feed-forward layer of the RNN to classify the intent.

RNNs are Forgetful

RNNs only “remember”
the most recent few steps.

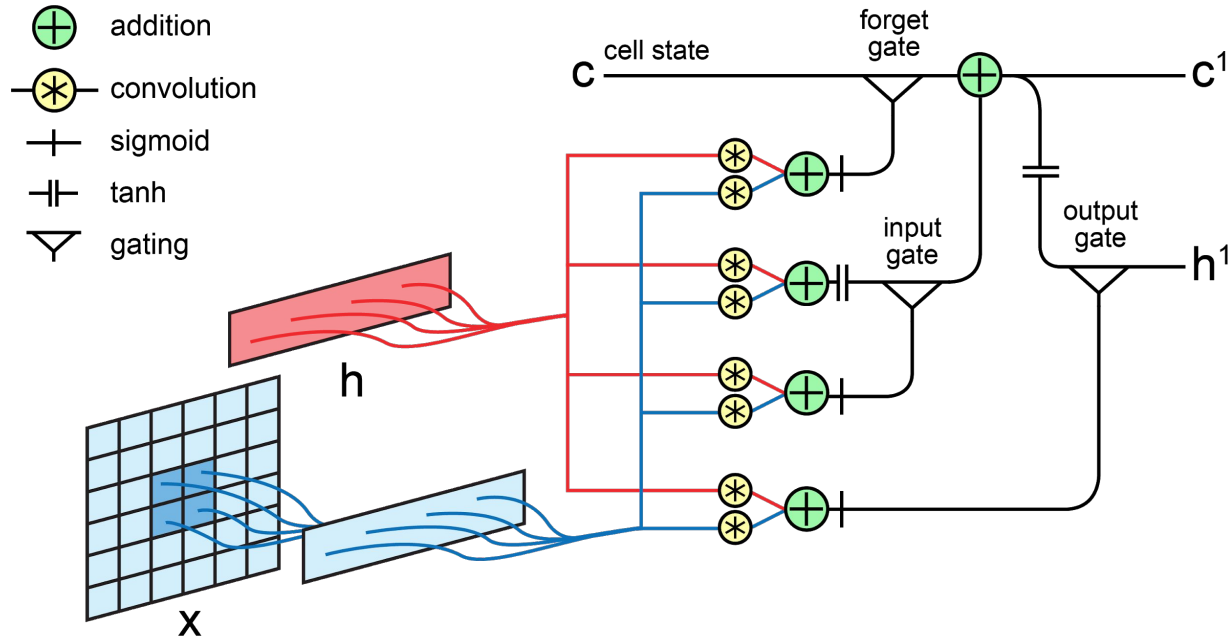
The vanishing gradient in the hidden states illustrates an issue with RNN's known as **short-term memory**.



Long Short Term Memory (LSTM)

LSTMs to the Rescue

LSTM (Long Short Term Memory) RNNs are one solution for longer time windows. An LSTM RNN works like an original RNN, but it decides selectively which types of longer-term events are worth remembering, and which are OK to forget.





Instructor Demonstration


Automatic Text Generation with RNN


Automatic Text Generation with RNN

In this demo, we will explore how an RNN can be used to automatically generate text.

Talk to Transformer

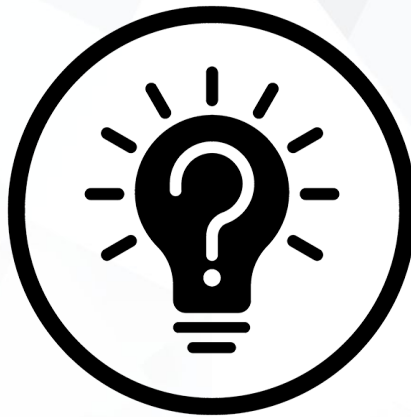
See how a modern neural network completes your text. Type a custom snippet or try one of the examples. [Learn more](#) below.

 [Follow @AdamDanielKing](#) for more neat neural networks.

Custom prompt 

Type something and a neural network will guess what comes next.

[COMPLETE TEXT](#)



Want to learn more about RNNs?

Take a Look at This Recurrent Neural Networks Cheat Sheet

Shervine AmidiAbout

ProjectsTeachingBlog

AboutAfshine Amidi

Recurrent Neural Networks

Overview

- Architecture structure
- Applications of RNNs
- Loss function
- Backpropagation

Handling long term dependencies

- Common activation functions
- Vanishing/exploding gradient
- Gradient clipping
- GRU/LSTM
- Types of gates
- Bidirectional RNN
- Deep RNN

Learning word representation

- Notations
- Embedding matrix
- Word2vec
- Skip-gram
- Negative sampling
- GloVe

Comparing words

- Cosine similarity
- t-SNE

View PDF version on GitHub

Would you like to see this cheatsheet in your native language? You can help us [translating it on GitHub!](#)

CS 230 - Deep Learning

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Convolutional Neural NetworksRecurrent Neural NetworksTips and tricks

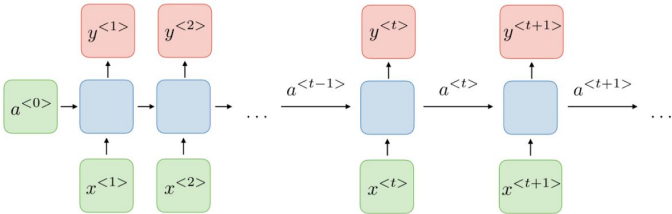
Recurrent Neural Networks cheatsheet

★ Star3,793

By Afshine Amidi and Shervine Amidi

Overview

Architecture of a traditional RNN — Recurrent neural networks, also known as RNNs, are a class of neural networks that allow previous outputs to be used as inputs while having hidden states. They are typically as follows:



For each timestep t , the activation $a^{<t>}$ and the output $y^{<t>}$ are expressed as follows:

$$a^{<t>} = g_1(W_{aa}a^{<t-1>} + W_{ax}x^{<t>} + b_a) \quad \text{and} \quad y^{<t>} = g_2(W_{ya}a^{<t>} + b_y)$$

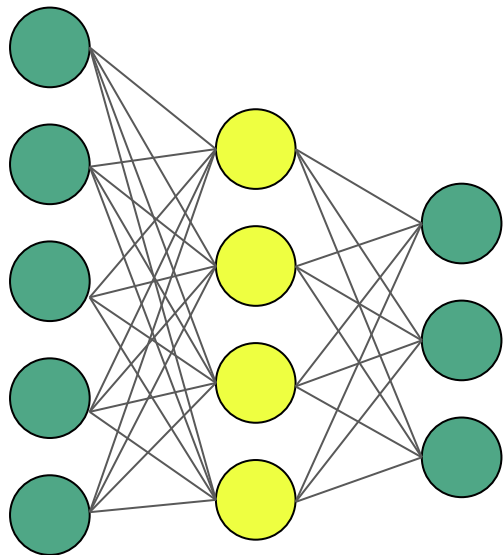
Introduction to Dropout

Introduction to Dropout

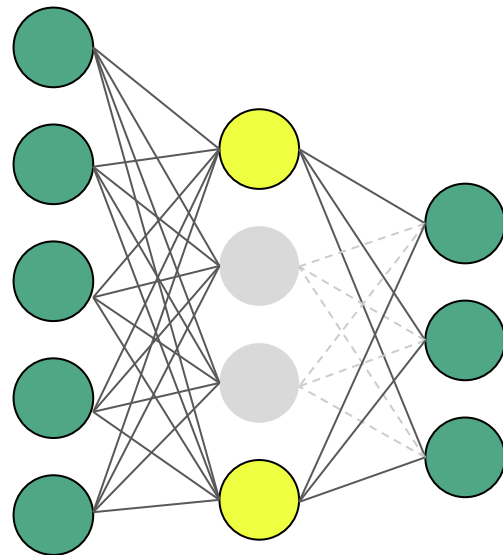
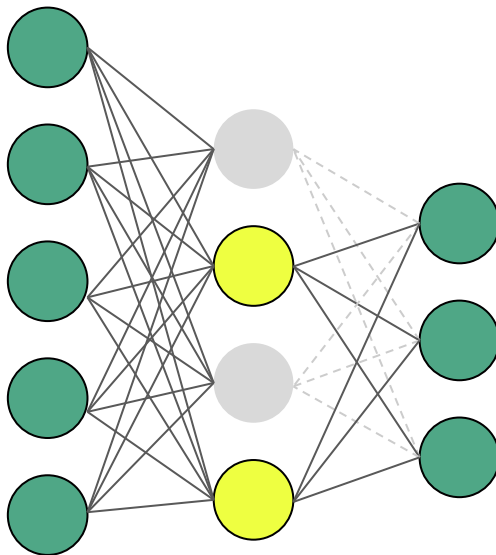
Dropout consists of removing units from the hidden layers, by randomly select a fraction of the hidden nodes and set their output to zero, regardless of the input.

A different subset of units is randomly selected every time we feed a training example.

Dropout



DropConnect





Questions?

*The
End*