SCIENTISTS USE AI TO PREDICT BIOLOGICAL AGE BASED ON SMARTPHONE AND WEARABLES DATA

HERMMY WANG


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Today
Exercise
Music
Coach
fitbit


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BP is trending down. Great job!

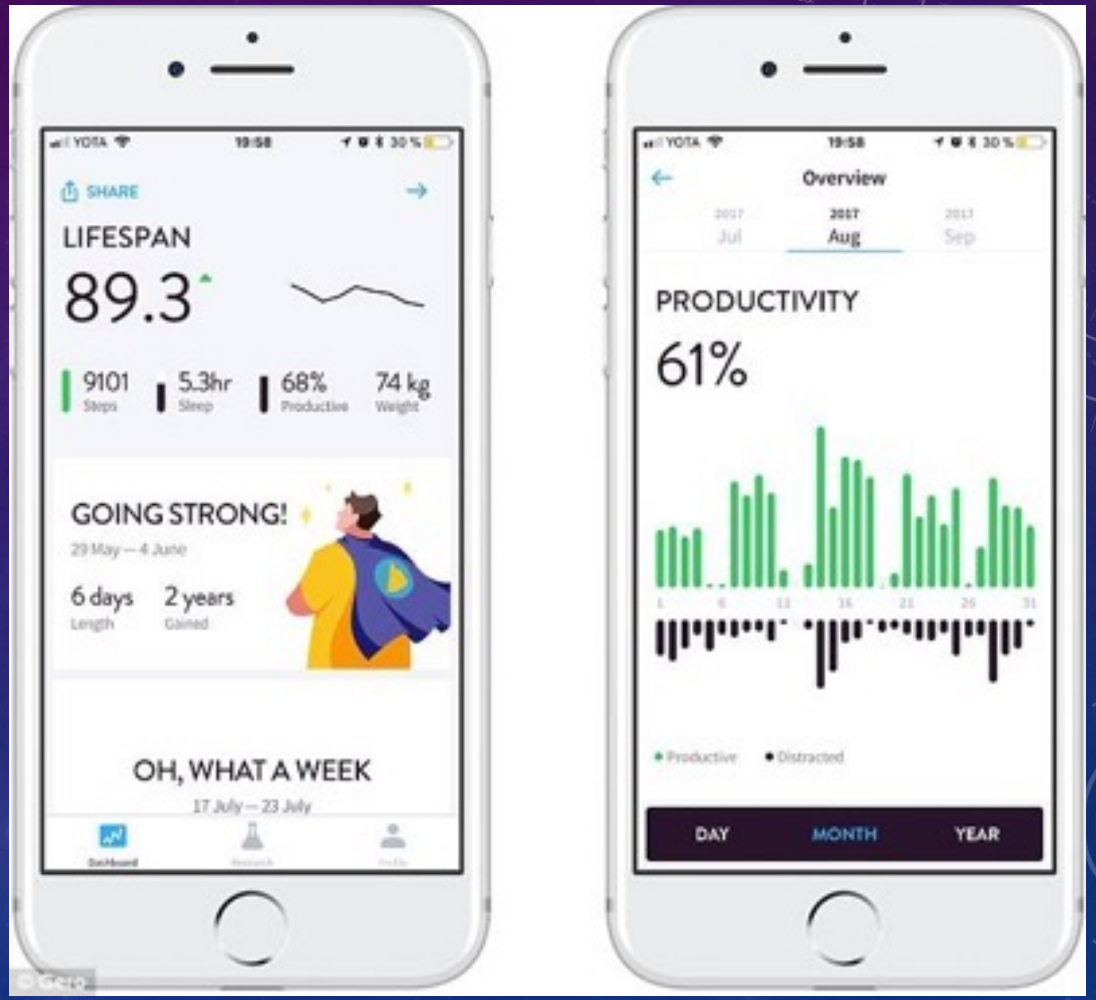
INTRODUCTION

- March, 2018
- GERO Biotech & Moscow Institute of Physics and Technology
- A computer algorithm that predicts biological age and mortality risk based on physical activities
- Combine wearable sensors and AI technologies to monitor health risks with real-time feedback to patients and care providers
- Team leader: Peter Fedichev, Ph.D.
  - The head of the Laboratory of Biological Systems Simulation at MIPT
  - GERO Science Director

"Recent promising examples [of Artificial Intelligence] in the field of medicine include neural networks showing cardiologist-level performance in detection of the arrhythmia in ECG data, deriving biomarkers of age from clinical blood biochemistry, and predicting mortality based on electronic medical records. Inspired by these examples, we explored AI potential for Health Risks Assessment (HRA) based on human physical activity."

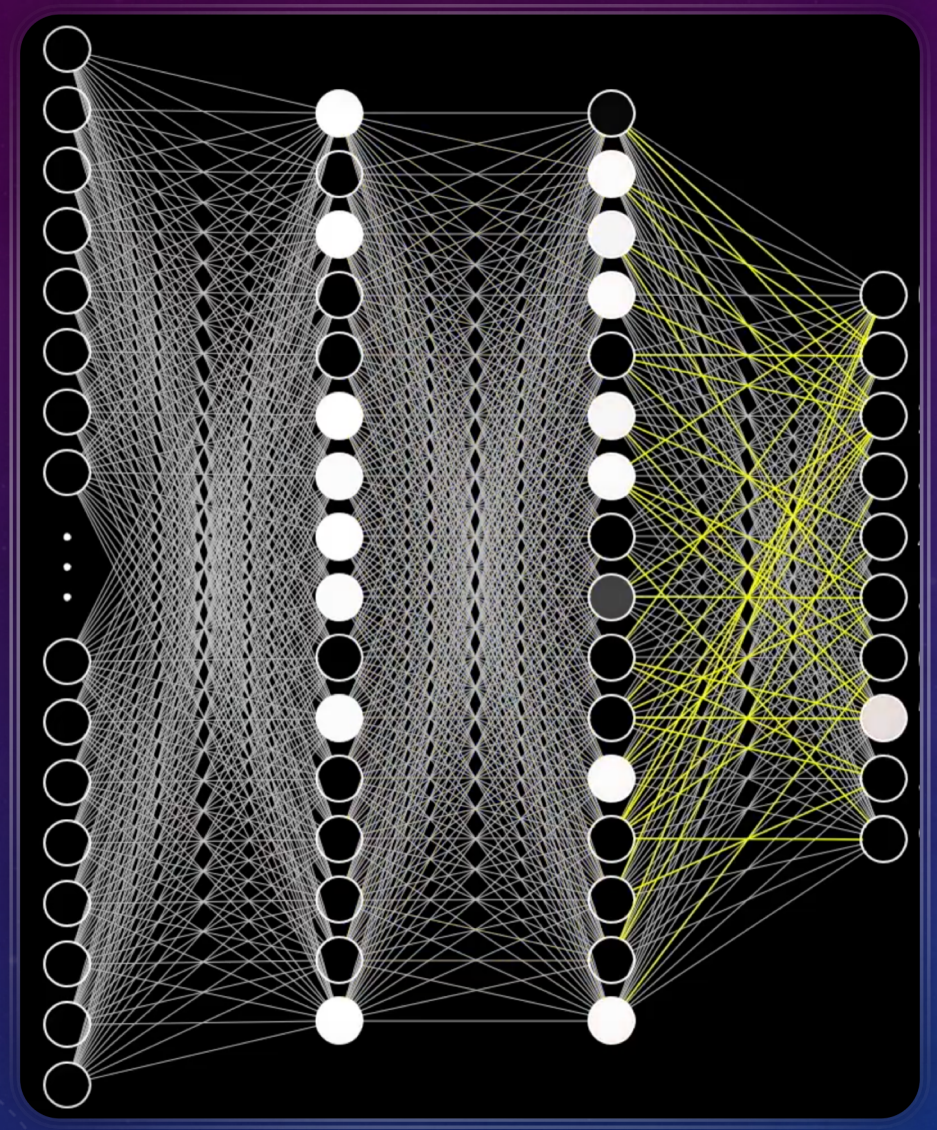
—Peter Fedichev

GERO LIFESPAN



WHAT ALGORITHM DO THEY USE?

HOW DOES IT WORK?

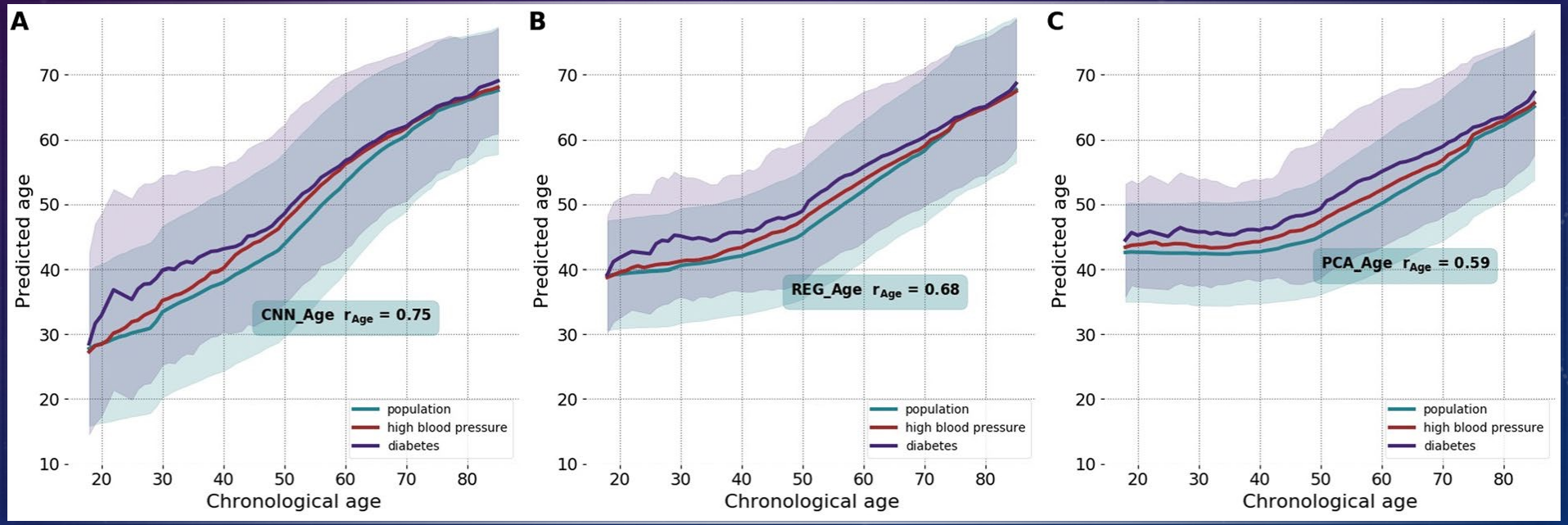


CONVOLUTIONAL NEURAL NETWORK

- Machine Learning
- Pattern recognition
- An artificial neural network that contains multiple convolution layers to detect patterns
  - Each convolution layer consists of many neurons that have learnable weights and biases.
- It is inspired by biological processes in that the connectivity pattern between CNN neurons resemble to the organization of animal's neural network.

DEEP CNN_AGE MODEL

- The researches build three age-estimating models:
  - Deep convolutional neural network (CNN_Age model)
  - Regularized multivariate regression (REG_Age model)
  - Principal component analysis (PCA_Age model)
- CNN_Age outperforms REG_Age and PCA_Age in terms of the chronological age prediction accuracy.



WHAT ALGORITHM DO THEY USE?

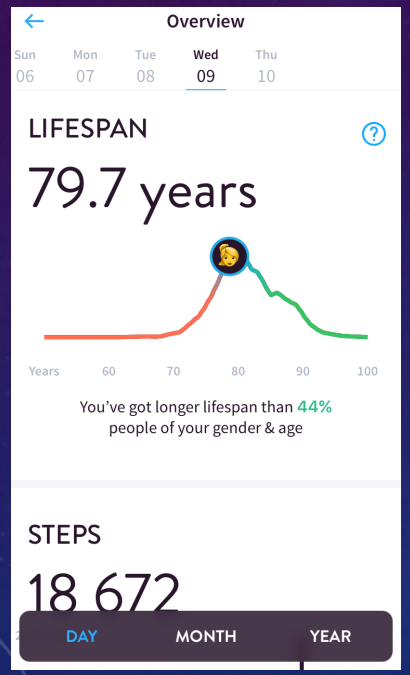
HOW DOES IT WORK?

Input

Physical activity data recorded by wearable devices. Each record is a vector of 10080 values representing activity counts.

Output

The predicted age.

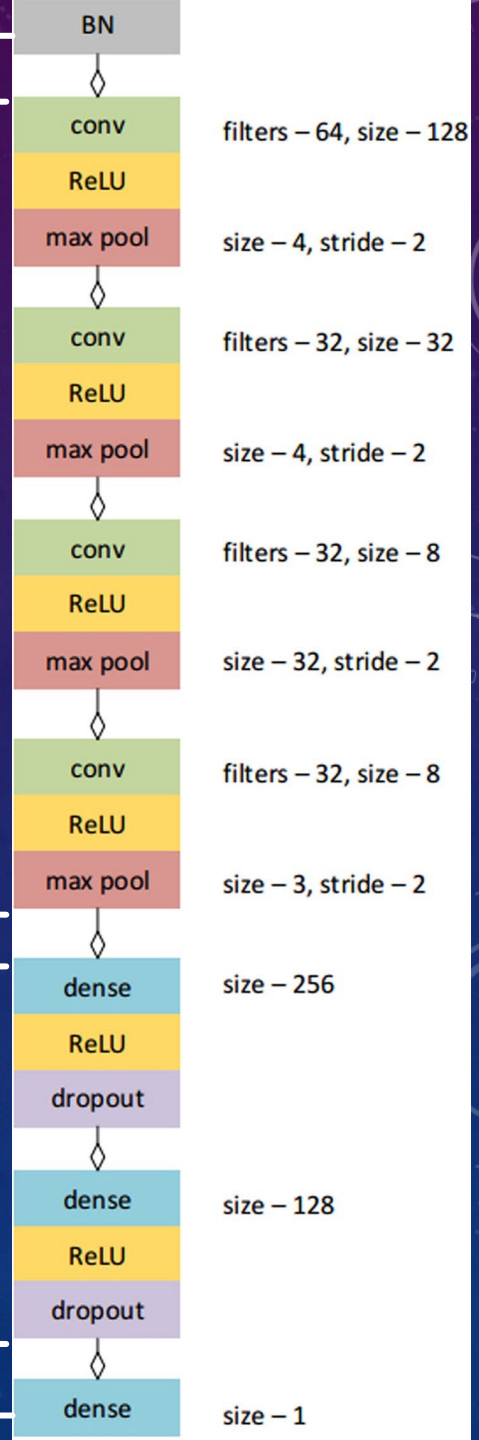


Convolution

4 Convolution layers followed by ReLU activation and max pooling.

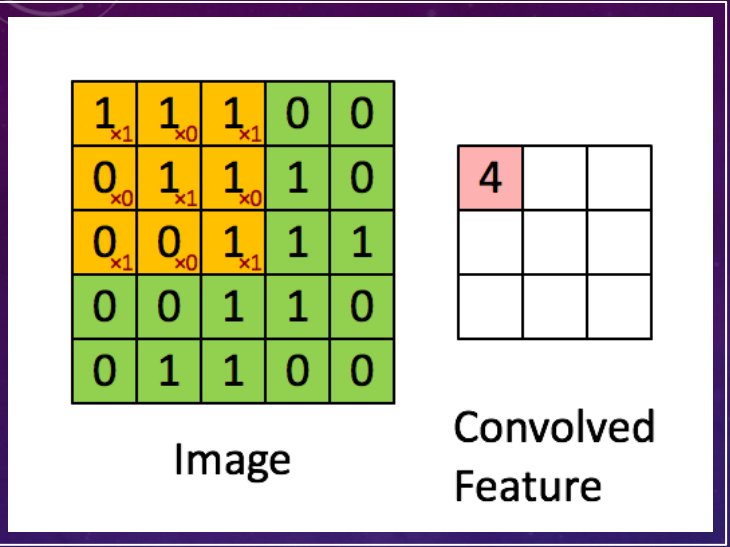
Classification

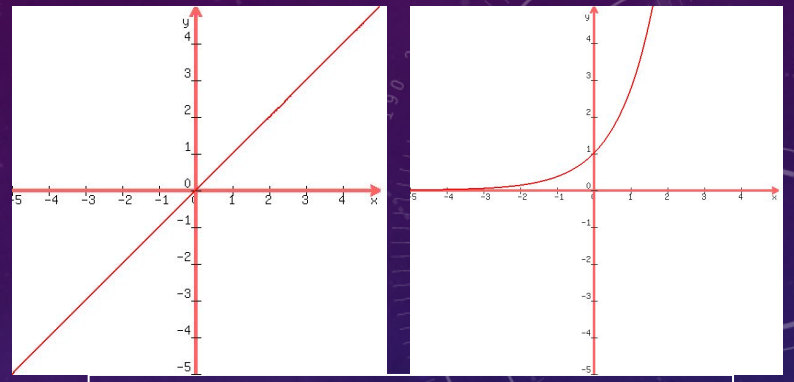
2 Fully connected layers followed by ReLu activation and dropout regularization.



Convolution layer

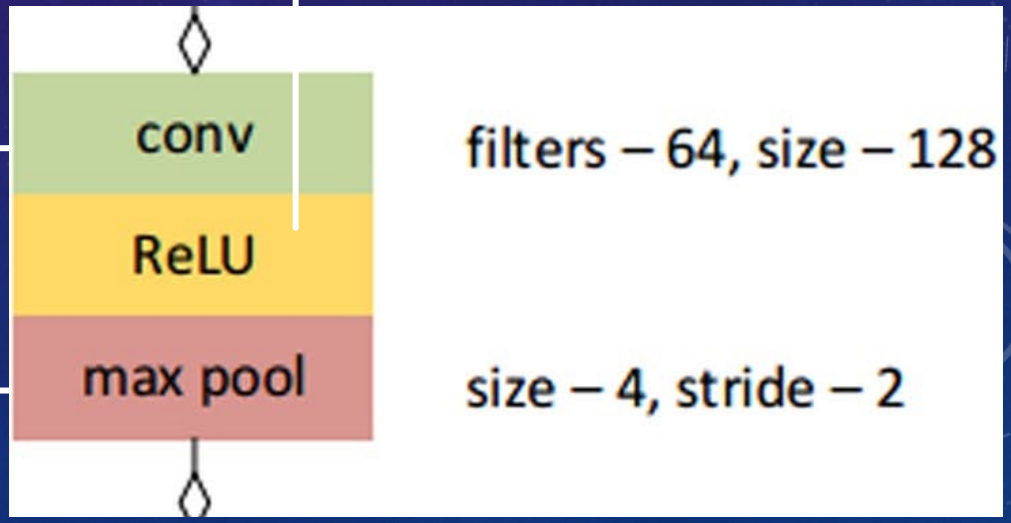
- A filter, or a feature detector, convolves the input and compute dot products.
- The output is a feature map, a matrix representation of input data.
- Learn the filter patterns on its own during the training process.





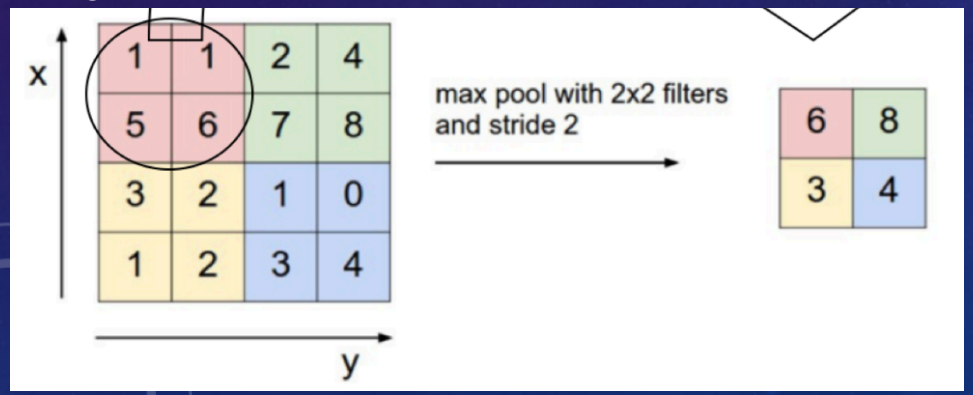
Rectified Linear Unit

Introduce non-linearity



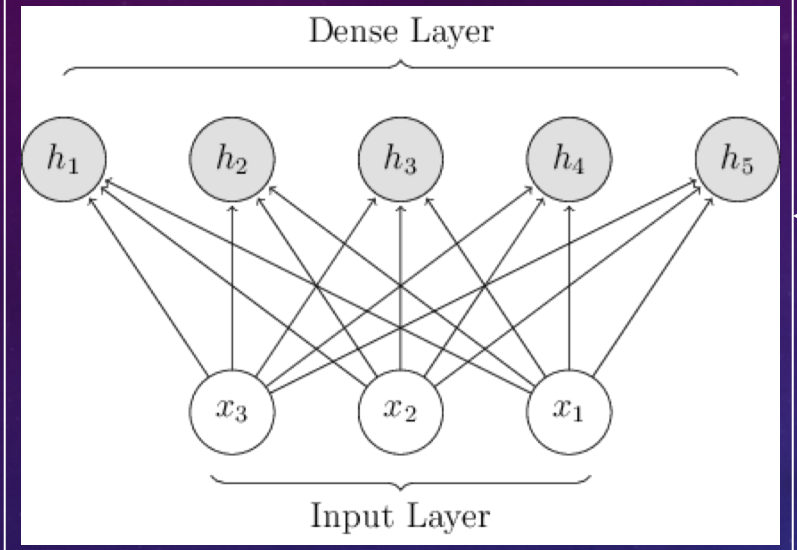
Max pooling

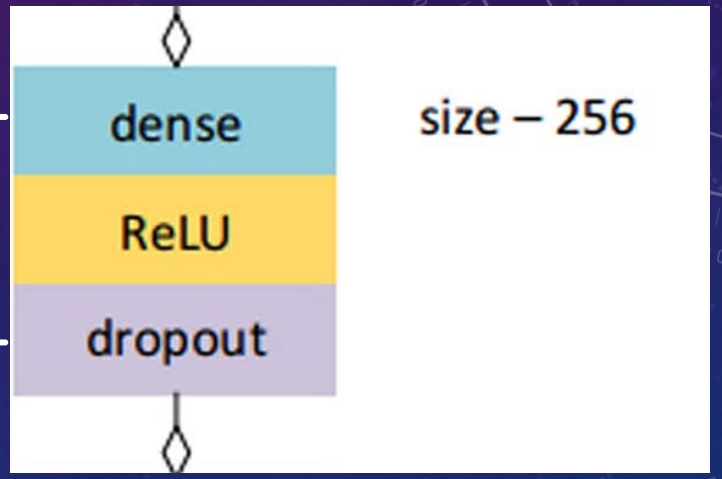
Make the input representations smaller and more manageable.



Dense Layer

- Also called a fully connected layer.
- To classify the input into various classes based on the training dataset.



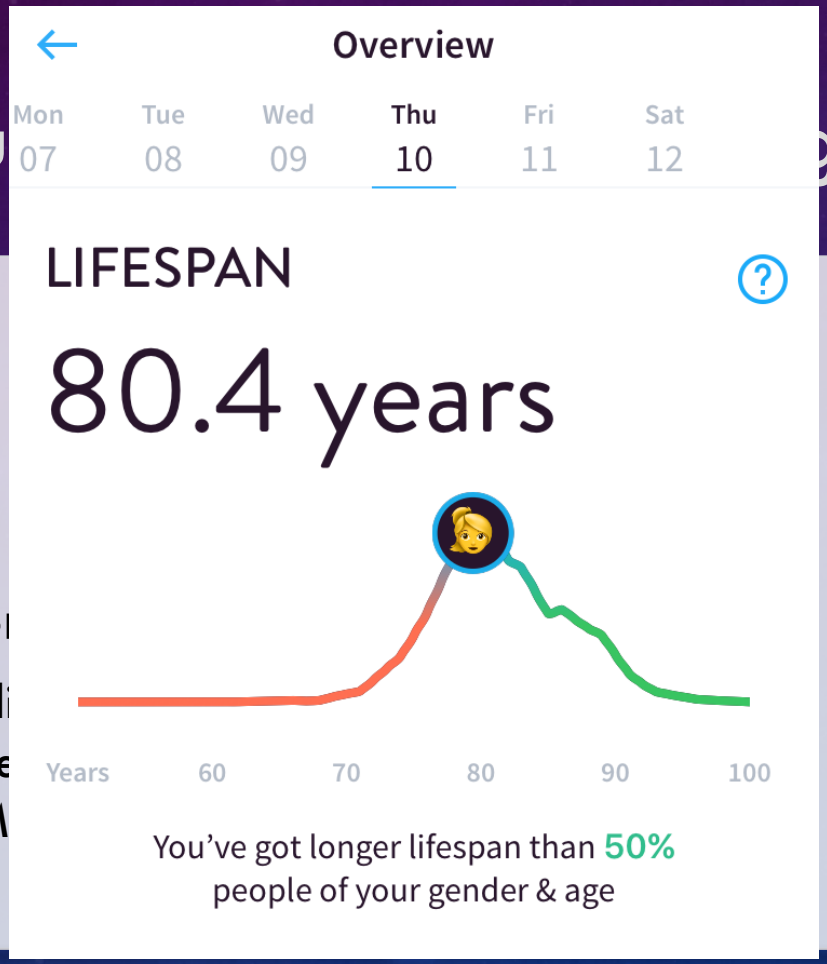


Dropout

- A regularization technique for reducing overfitting in neural networks by preventing complex co-adaptations on training data.
- Overfitting: the production of an analysis that corresponds too closely to one particular set of data.

SUMMARY

How is the convolu ge model trained?



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Input

- Feeding physical activity records from wearables

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Output

- A single linear neuron
- Resulting value of age prediction

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