

Deep learning approaches for forecasting the global spread of influenza

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Outline

- 1 Introduction
- 2 Background
- 3 Objectives
- 4 Methodology
- 5 Timeline

Influenza

Overview

Influenza

Diagnosis

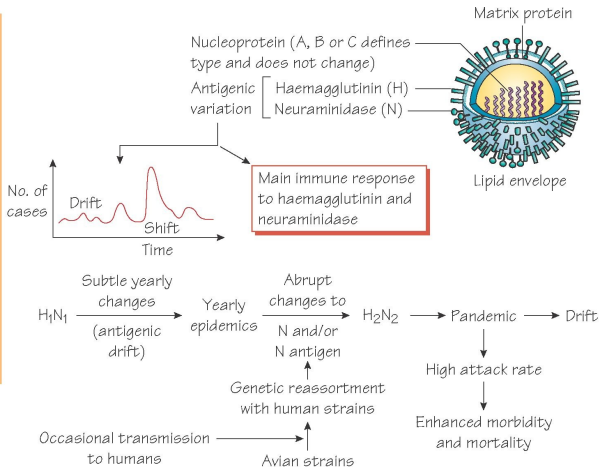
- Nasopharyngeal aspirate
 - Direct immunofluorescence
 - Culture
 - NAAT detection
- Serum
 - Serology

Treatment + prevention

- Amantadine
- Zanamivir
- Oseltamivir
- Vaccination

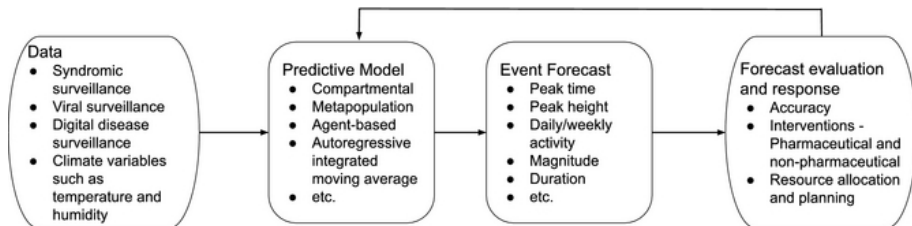
N.B.

Secondary bacterial infection



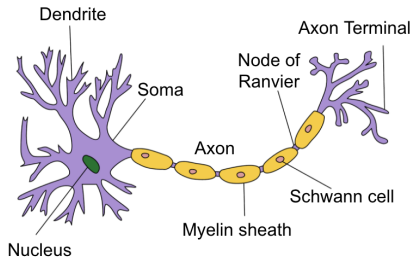
Background

Influenza forecasting methods



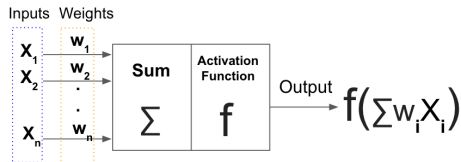
credit : <http://onlinelibrary.wiley.com/doi/10.1111/irv.12226/fullirv12226-fig-0001>

Deep Learning



Structure of a typical neuron

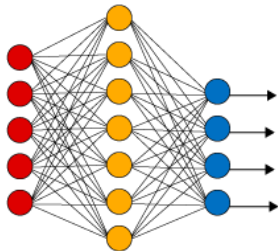
(source: Wikipedia)



Structure of artificial neuron

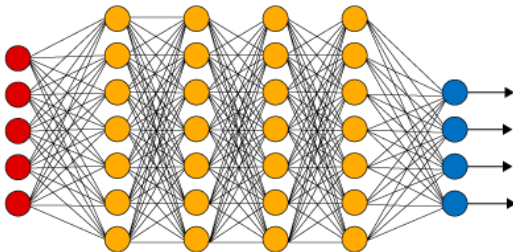
Deep Learning

Simple Neural Network



● Input Layer

Deep Learning Neural Network



● Hidden Layer

● Output Layer

credit : <https://hackernoon.com/log-analytics-with-deep-learning-and-machine-learning-20a1891ff70e>

Research questions

The goal of this thesis is to assess if Deep Learning approaches produce good prediction for influenza activities.

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- Design the architecture of a neural network

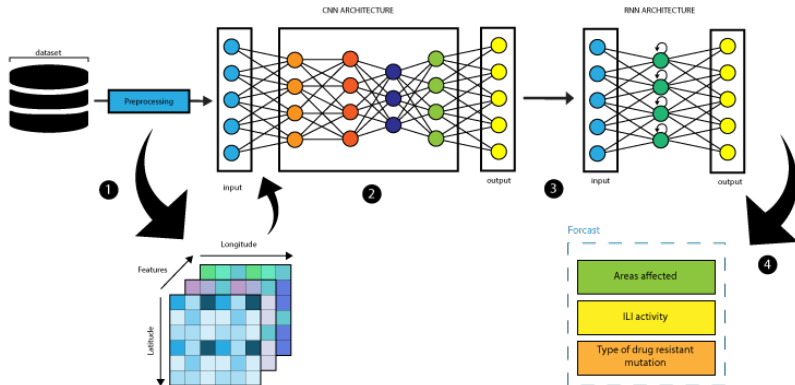
The goal of this thesis is to assess if Deep Learning approaches produce good prediction for influenza activities.

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- Pipeline to automate the data retrieval process

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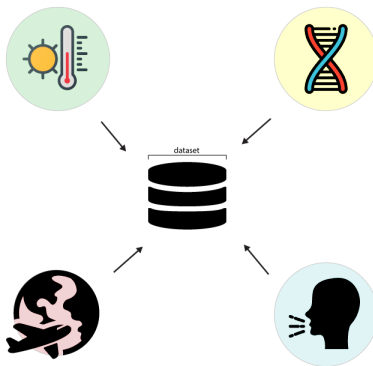
- Design the architecture of a neural network
- Pipeline to automate the data retrieval process
- Asses the overall performance

Methodology



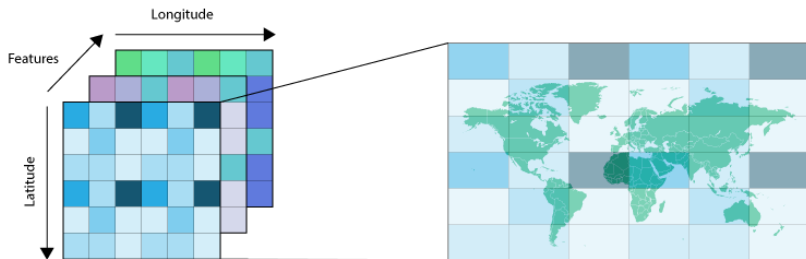
Data acquisition

Dataset

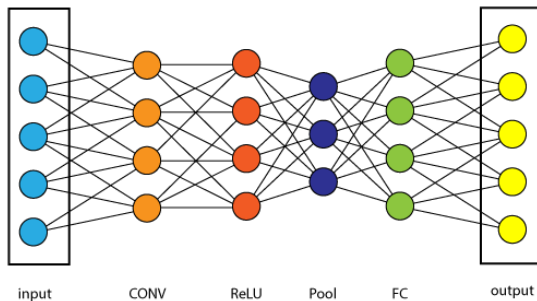


Data acquisition

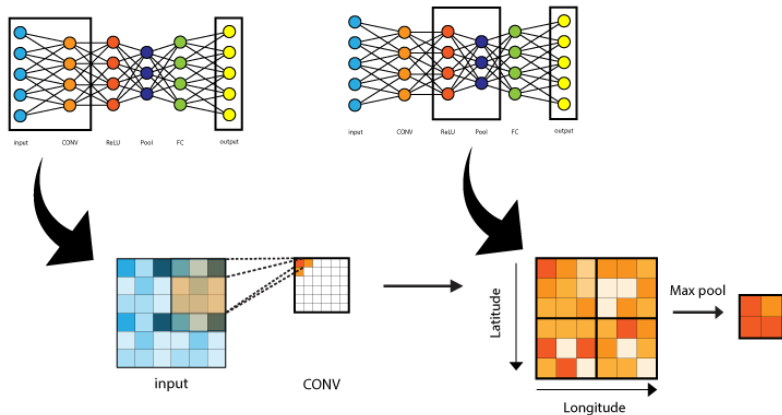
Preprocessing



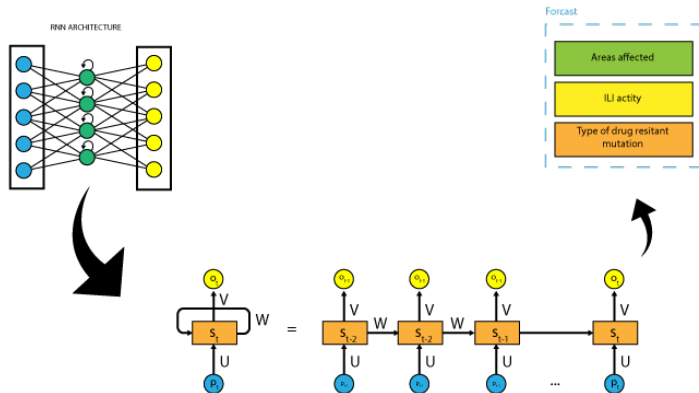
Convolutional Neural Networks



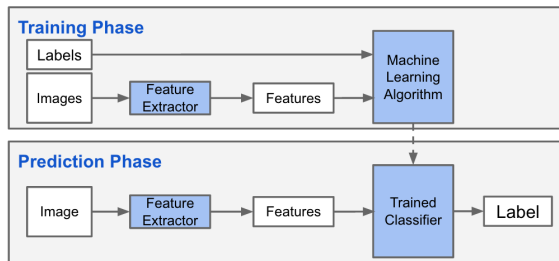
Convolutional Neural Networks



Recurrent Neural Network



Training and Implementation



Machine Learning Phases

credit :<http://adilmoujahid.com/images/machine-learning-training-prediction-2.png>

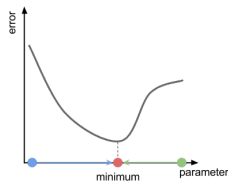
Training and Implementation

Gradient Descent

$$\text{observed data} \rightarrow y = b_0 + b_1x + \varepsilon$$

$$\text{predicted data} \rightarrow y' = b_0 + b_1x$$

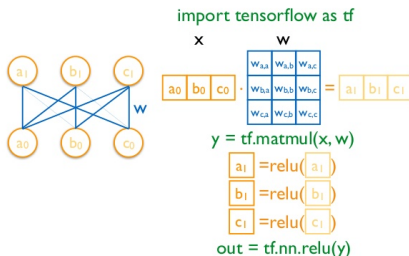
$$\text{error} \rightarrow \varepsilon = y - y'$$



Training and Implementation

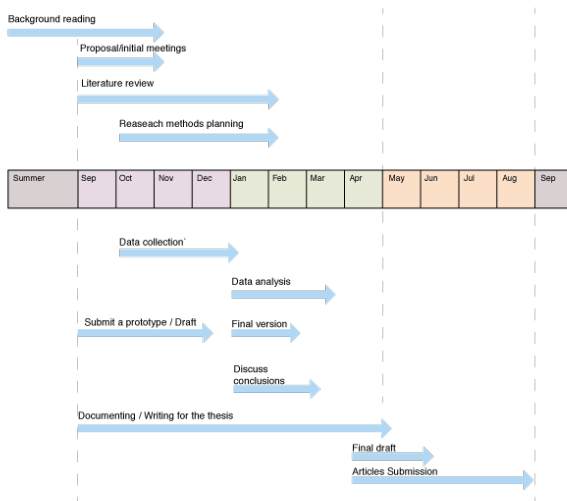
Tensorflow

With TensorFlow



credit : <https://image.slidesharecdn.com/iispublic-160102031649/95/google-tensorflow-tutorial-4-638.jpg?cb=1451704817>

Timeline



The motivation of this research is to expand the knowledge on predictive methods based on DL approaches for surveillance and forecasting of infectious diseases and explores the relevance of using DL in application to influenza forecasting