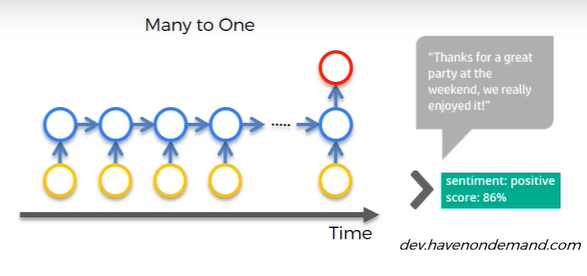
**RESEARCH**

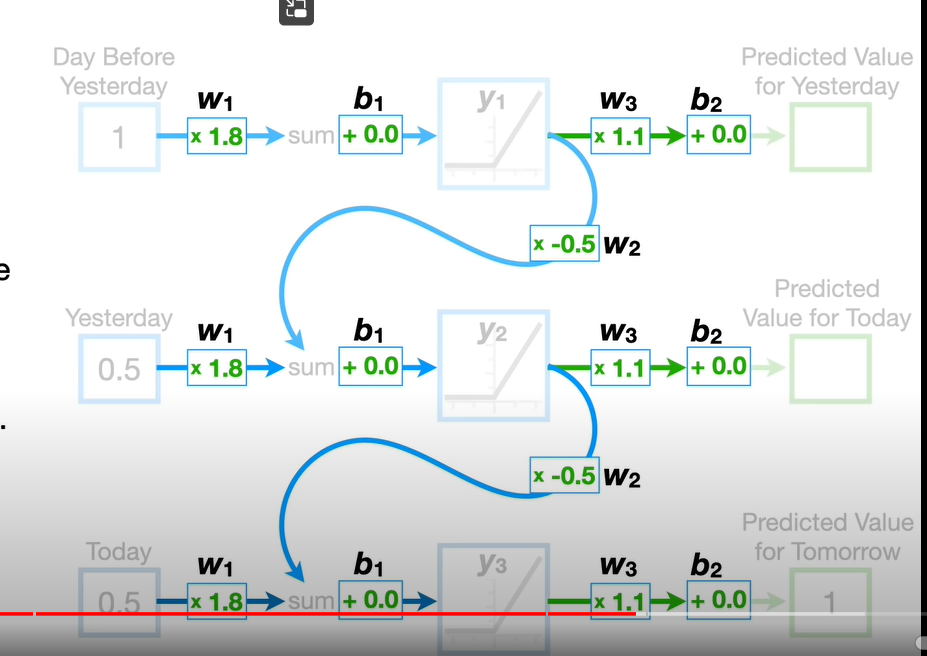
**BREATHING WAVE PATTERN**

Deep Learning – RNN using LSTM

Using the **“Many to One”** RNN Schema to predict only categorical values.



RNN - https://youtu.be/AsNTP8Kwu80



This is the traditional RNN Process, and this is not used often because of the **VANISHING & EXPLODING GRADIENT PROBLEM,** which say if the NUMBER of UNROLL is so many it will creating extreme multiplication for the gradient value, and it will resulting vanished / exploded the model.

**SOLUTION**

1. **Exploding Gradient**
   1. **Truncated Backpropagation**

Stopping updating the weight across all NN, only certain amount NN will be updated this will creating not optimal model.

* 1. **Penalties**

Gradient being penalized / artificial reduced

* 1. **Gradient Clipping**

Limit the gradient

1. **Vanishing Gradient**
   1. **Weight Initialization**

How smart you initialize the value of weight

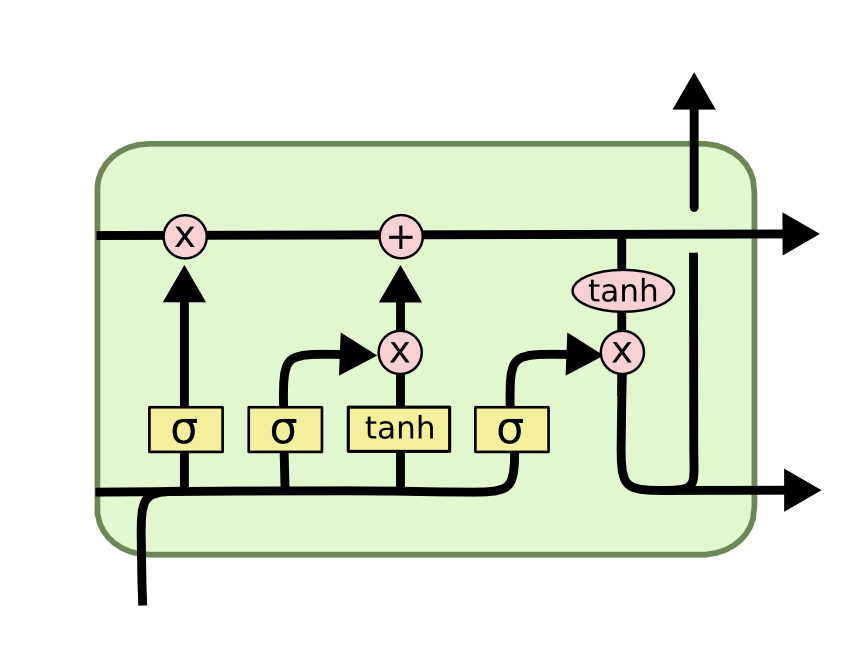
* 1. **Echo State Networks**
  2. **Long Short-term Memory Network (LSTMs)**

**ht**

**LSTM**

**Forgot Valve**

**Adding Valve**



**Output Valve**



**Xt**

**Ct**

**Ct - 1**

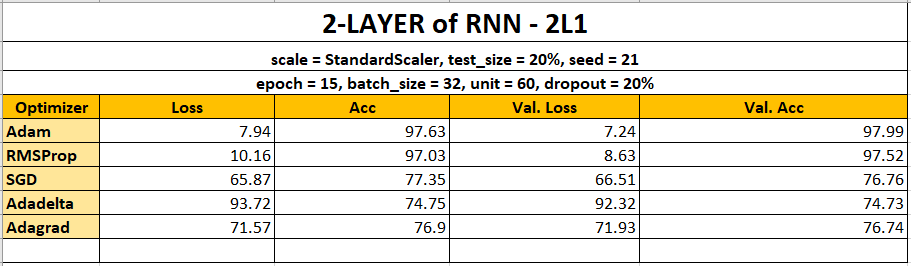
**ht - 1**

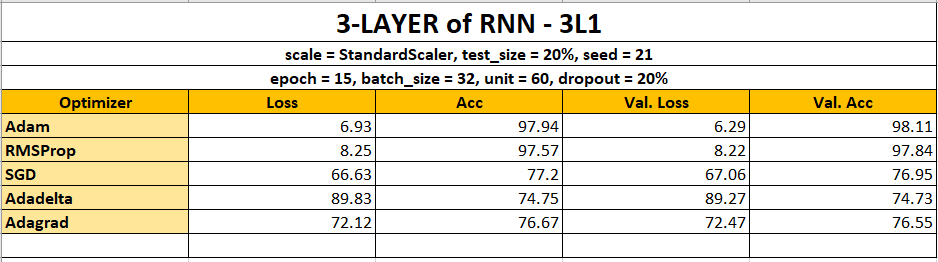
**ht**

**MODEL (WITHOUT MFCC)**

**HOLD-OUT Cross Validation**

1. 80% training and 20% testing
2. Accuracy of different Optimizer

****

****

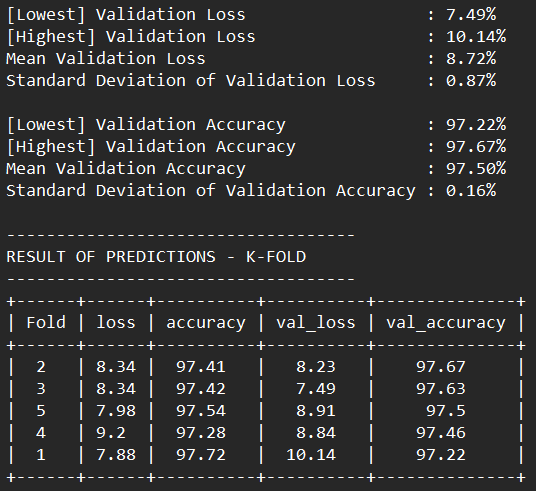


**BEST ACCURACY : 98.11%**

**OPTIMIZER : Adam**

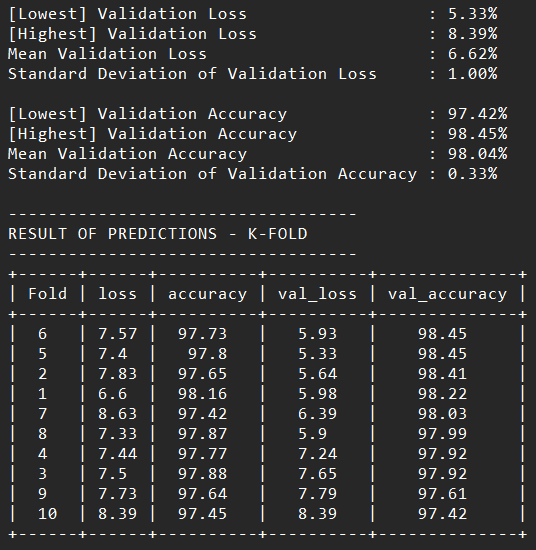
**Stratified K-FOLD**

1. **5-FOLD**

****

**NB.** Sorted by ‘val\_accuracy’

1. **10-FOLD**

****

**NB.** Sorted by ‘val\_accuracy’

**BEST FOLD : 10-FOLD**

Lower ‘val\_loss’ and higher ‘val\_accuracy’

**There is no sign of Overfitting**. Training loss is greater than validation loss

**There is no sign of Underfitting**. Training loss and Validation loss are not about equal, they have bigger gap of value for each.

Souce : [GitHub - karpathy/char-rnn: Multi-layer Recurrent Neural Networks (LSTM, GRU, RNN) for character-level language models in Torch](https://github.com/karpathy/char-rnn#tips-and-tricks)

List ALL the information Parameters – ada di TEAMS

|  |  |  |  |
| --- | --- | --- | --- |
| **MODEL** | **HYPERPARAMETER** | **VALUES** | **FINAL VALUE** |
| **RNN (LSTM)** | epoch  batch\_size  dropout\_rate  init\_mode  init\_activation  init\_recurrent | 15, 20  32, 64  0.1, 0.2, 0.3, 0.4, 0.5  ‘glorot\_uniform’, ‘he\_uniform’  ‘tanh’, ‘relu’  ‘glorot\_uniform’, ‘orthogonal’ |  |

**[OPTIONAL] INFORMATION**

**NVIDIA RTX 3060 vs Intel i9 11900F (in minutes)**

|  |  |  |  |
| --- | --- | --- | --- |
| **MODEL** | **TASK** | **NVIDIA RTX 3060** | **Intel Core i9 11900F** |
| Whisper Open AI | Transcribe 10 Minute English Video | 1.32 | 9.10 |