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| **Assignment Case** |  |
| COMP7117  Artificial Neural Network |
| **Computer Science** | **O203-COMP7117-KF04-02** |
| ***Valid on*** *Even Semester Year 2020/2021* | **Revision 00** |

1. Seluruh mahasiswa tidak diperkenankan untuk:

*All students are not allowed to:*

* + 1. Berdiskusi dan/atau bekerja sama dengan mahasiswa lainnya

*Discuss and/or work together with other student participants*

* + 1. Melihat sebagian atau seluruh jawaban mahasiswa lain

*Seeing a part or the whole answer from another student*

* + 1. Membuka dan menyalin dari **BUKU** atau **CATATAN**, **VIDEO** dari pengajar (recording kelas, VBL, Youtube, dsb) dan **REFERENSI** lainnya

*Open and copy from any resources such as notes, videos (class recording, VBL, Youtube, etc) and other references*

* + 1. Membuka dan menyalin jawaban dari internet (google, stackoverflow, dsb)

*Open and copy answer from the internet (google, stackoverflow, etc)*

* + 1. Mengerjakan soal yang tidak sesuai dengan tema yang ada di soal,

*Working with another theme which is not in accordance with the existing theme in the matter of the case,*

* + 1. Melakukan tindakan kecurangan lainnya,

*Committing other dishonest actions,*

* + 1. Secara sengaja maupun tidak sengaja melakukan segala tindakan kelalaian yang menyebabkan hasil karyanya berhasil dicontek oleh orang lain / kelompok lain.

*Accidentally or intentionally conduct any failure action that cause the results of the project was copied by someone else / other groups.*

1. Jika mahasiswa terbukti melakukan tindakan seperti yang dijelaskan butir 1 di atas, maka **nilai mahasiswa** yang melakukan kecurangan (menyontek maupun dicontek) akan di – **NOL** – kan.

*If the student is proved to the actions described in point 1 above, the score of the student which committed dishonest acts (cheating or being cheated) will be “Zero”*

1. Perhatikan jadwal pengumpulan jawaban, segala jenis pengumpulan jawaban di luar jadwal tidak dilayani.

*Pay attention to the submission schedule, all kinds of submission outside the schedule will not be accepted*

1. Bila Anda tidak membaca peraturan ini, maka Anda dianggap telah membaca dan menyetujuinya

*If you have missed to read these regulations, so you are considered to have read and agreed on it*

1. Persentase penilaiaan untuk matakuliah ini adalah sebagai berikut:

*Marking percentage for this subject is described as follows:*

|  |  |
| --- | --- |
| **Tugas Mandiri**  *Assignment* | **Proyek**  *Project* |
| 40% | 60% |

1. Software yang digunakan pada matakuliah ini adalah sebagai berikut:

*Software will be used in this subject are described as follows:*

|  |
| --- |
| **Software**  *Software* |
| Python 3.7  SciKit 0.23.1  SciPy 1.5.0  TensorFlow 1.15.0  Visual Studio Code |

## Ekstensi file yang harus disertakan dalam pengumpulan tugas mandiri dan proyek untuk matakuliah ini adalah sebagai berikut:

*File extensions should be included in assignment and project collection for this subject are described as follows:*

|  |  |
| --- | --- |
| **Tugas Mandiri**  *Assignment* | **Proyek**  *Project* |
| PY | PY |

## Soal

*Case*

**Japan Birth Rate**

**Japan**’s **Ministry of Civilian** is responsible for **enhancing productivity** and **growth** in **birth rate** to increase the **population** in **Japan**. One of the innovations is to **analyze** and **forecast** the **birth count data**, especially the **birth count**. To help them, they hire you as an AI Specialist to **create a system** to **forecast** **the** **birth count** based on the **history of birth rate data**. The system will be built using **recurrent neural network** technique, implemented in **Python** with the help of **NumPy** and **Tensorflow** library.

1. **Dataset Description**

**Content**

The dataset consists of **52 time-series data** taken from the **history of Japan’s birth count** from **March 2001** until **December 2012**. The data is used to **determine the future birth count** in **Japan**.

1. **Architecture**

The architecture for the neural network is as follows:

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| --- | --- |
| **Architecture** | **Notes** |
| Input Layer | 1 neuron |
| Context unit | 4 neurons |
| Output Layer | 1 neuron |
| Unroll count | 2 |

The activation function used for all layers is **sigmoid function**.

1. **Training**

The training is done with **gradient descent** **optimization** formula for **1,000 epochs** and use **75% of the dataset**. The **training method** is **mini-batch gradient descent** with **4 data per batch**.

The training procedures are as follows:

1. **Initialization**

The initialization step needs to be **run once** before starting the training iteration:

1. The **data in the dataset need to be normalized** before being passed to the neural network. Below is the **formula** of **normalization**:

|  |
| --- |
|  |

1. **Initialize** the **weights and biases randomly**
2. **Iteration**

For **1,000 epochs**, repeatthe following:

1. **Calculate the error** by comparing the output of the neural network to the target in the dataset **using mean squared error** (**MSE**)
2. **Update** the **weights and biases** using **gradient descent optimization**
3. **For every 200 epochs**, **print** the **current error** and **iteration number** to the console
4. **For every 100 epochs**, **save** the **variables** to **checkpoints**

The formula required for the training process can be found in the Appendix section.

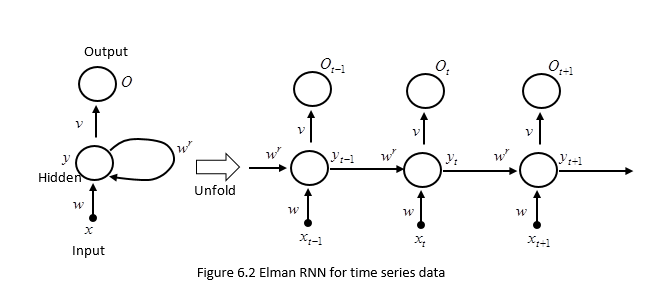
1. **Evaluation**

The neural network will be **evaluated** using **25% of the dataset** using the **model** that **previously** has been **saved**. The result will be the **predicted** **visitor numbers** in **New Zealand** on the **following** **month**.

1. **Appendix**

**Recurrent Neural Network**

These are the formulas for a neural network trained with recurrent neural network.



**Forward Pass**

The forward pass formulas are:

* First layer (Input layer to hidden layer)
  + Before feedback loop
  + After feedback loop
* Second layer (hidden layer to output layer)

**Backward Pass**

The backward pass formulas are:

* Error calculation (Mean square error)
* Weight update
* Bias update

\* In TensorFlow, use an optimizer instead of updating the weights and biases manually.

**Reference**

* The dataset is obtained from Time Series Weebly

(https://timeseries.weebly.com/uploads/2/1/0/8/21086414/\_births\_and\_deaths.csv)