# Video Tutorial

https://youtu.be/uLMxC_1glJM

# Download Base Project

https://github.com/zenzen0014/nn_deep_learn/tree/master/scripts

# Download ATOM

https://atom.io/

# Index.html

```
<script type="text/javascript">
  let nn;//neural network

  $("#start").click(function(){

    lr = $("#lr").val();
    e = $("#epoch").val();

    generate_ai(lr, e);
  })

  function generate_ai(lr, e){//lr learning rate, e epoch
    let training_data = [{
      inputs: [0.05, 0.1],
      outputs: [0.99]
    }];
    let start_time = Date.now();
```

# Index.html

```
let start_time = Date.now();

nn = new NeuNet(
  2, 2, 1, 1,// i, h1, h2, T
  [
    [0.2, -0.3],//w1 w2
    [0.15, -0.5]//w3 w4
  ],
  [1, 1],//b1
  [
    [-0.4, 0.3]//w5 w6
  ],
  [0.5],//b2
  [
    [0.25]//w7
  ],
  [1]//b3
)
```

Index.html

```
    for(n = 0; n < e; n++){ //e
      for(i = 0; i < 50; i++){
        a = nn.training(training_data[0].inputs, training_data[0].outputs)
      }
      nn.setLearningRate(lr);// lr
      y = nn.prediction(training_data[0].inputs);
      let elapsed_time = (Date.now() - start_time)/1000;

      if(n == (e-1)){
        $("#mse").val(`${a[0].toFixed(4)} %`);
        $("#output").val(`${y[0].toFixed(4)}`);
        $("#etime").val(`${elapsed_time} seconds`);
      }
    }
  }

</script>
```

# sketch.js

sketch.js

```
class ActivationFunction {
    constructor(func, dfunc) {
        this.func = func;
        this.dfunc = dfunc;
    }
}

let sigmoid = new ActivationFunction(
    x => 1 / (1 + Math.exp(-x)),
    y => y * (1 - y)
);
```

# sketch.js

sketch.js

```
class NeuNet {
    constructor(
        ilayer,
        hlayer,
        Hlayer,
        olayer,
        weight_ih = null,
        hbias = null,
        weight_hh = null,
        Hbias = null,
        weight_ho = null,
        obias = null
    ) {
        if (ilayer instanceof NeuNet) {
            let lyr = ilayer;
            this.input_nodes = lyr.input_nodes;
            this.hidden_nodes = lyr.hidden_nodes;
            this.Hidden_nodes = lyr.Hidden_nodes;
            this.output_nodes = lyr.output_nodes;

            this.weight_ih = lyr.weight_ih.copy();
            this.weight_hh = lyr.weight_hh.copy();
            this.weight_ho = lyr.weight_ho.copy();

            this.hbias = lyr.hbias.copy();
            this.Hbias = lyr.Hbias.copy();
            this.obias = lyr.obias.copy();
        } else {⋯}
        this.setLearningRate();
        this.setActivationFunction();
    }
```

# sketch.js

sketch.js

```
class NeuNet {
    constructor(…) {
        if (ilayer instanceof NeuNet) {…
        } else {
            this.input_nodes = ilayer;
            this.hidden_nodes = hlayer;
            this.Hidden_nodes = Hlayer;
            this.output_nodes = olayer;
            this.weight_ih = new Matrix(this.hidden_nodes, this.input_nodes);
            this.weight_hh = new Matrix(this.Hidden_nodes, this.hidden_nodes);
            this.weight_ho = new Matrix(this.output_nodes, this.Hidden_nodes);
            this.hbias = new Matrix(this.hidden_nodes, 1);
            this.Hbias = new Matrix(this.Hidden_nodes, 1);
            this.obias = new Matrix(this.output_nodes, 1);

            let wih = Matrix.subtract_array(weight_ih, this.hidden_nodes, this.input_nodes);
            let bih = Matrix.fromArray(hbias);
            let whh = Matrix.subtract_array(weight_hh, this.Hidden_nodes, this.hidden_nodes);
            let bhh = Matrix.fromArray(Hbias);
            let who = Matrix.subtract_array(weight_ho, this.output_nodes, this.Hidden_nodes);
            let bho = Matrix.fromArray(obias);

            this.weight_ih = wih;
            this.weight_hh = whh;
            this.weight_ho = who;
            this.hbias = bih;
            this.Hbias = bhh;
            this.obias = bho;
        }
        this.setLearningRate();
        this.setActivationFunction();
    }
```

# sketch.js

```
setLearningRate(LearningRate = 0.1) {
    this.LearningRate = LearningRate;
}

setActivationFunction(func = sigmoid) {
    this.ActFunc = func;
}

prediction(input_array) {
    let inputs = Matrix.fromArray(input_array);

    let hidden = Matrix.multiply(this.weight_ih, inputs);
    hidden.add(this.hbias);
    hidden.map(this.ActFunc.func);

    let Hidden = Matrix.multiply(this.weight_hh, hidden);
    Hidden.add(this.Hbias);
    Hidden.map(this.ActFunc.func);

    let output = Matrix.multiply(this.weight_ho, Hidden);
    output.add(this.obias);
    output.map(this.ActFunc.func);

    return output.toArray();
}
```

# sketch.js

sketch.js

```
training(input_array, target_array) {
    let inputs = Matrix.fromArray(input_array);

    let hidden = Matrix.multiply(this.weight_ih, inputs);
    hidden.add(this.hbias);
    hidden.map(this.ActFunc.func);

    let Hidden = Matrix.multiply(this.weight_hh, hidden);
    Hidden.add(this.Hbias);
    Hidden.map(this.ActFunc.func);

    let outputs = Matrix.multiply(this.weight_ho, Hidden);
    outputs.add(this.obias);
    outputs.map(this.ActFunc.func);

    let targets = Matrix.fromArray(target_array);
    // Calculate the error ==> ERROR = TARGETS - OUTPUTS
    let output_errors = Matrix.subtract(targets, outputs);

    // let gradient = outputs * (1 - outputs);
    let gradients = Matrix.map(outputs, this.ActFunc.dfunc);
    gradients.multiply(output_errors);
    gradients.multiply(this.LearningRate);

    // Calculate deltas
    let Hidden_T = Matrix.transpose(Hidden);
    let weight_ho_deltas = Matrix.multiply(gradients, Hidden_T);
    this.weight_ho.add(weight_ho_deltas);
    this.obias.add(gradients);
```

# sketch.js

sketch.js

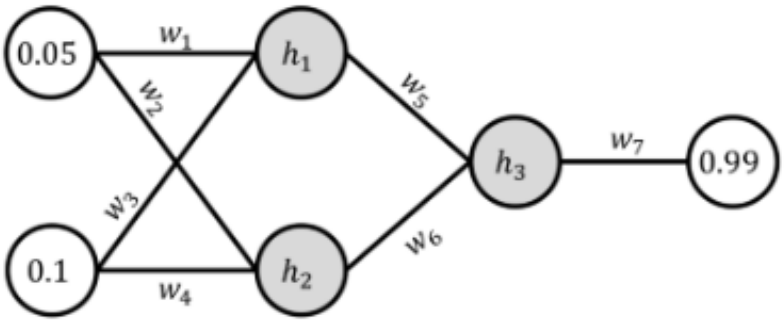
```
// let gradient = outputs * (1 - outputs);
let gradients = Matrix.map(outputs, this.ActFunc.dfunc);
gradients.multiply(output_errors);
gradients.multiply(this.LearningRate);

// Calculate deltas
let Hidden_T = Matrix.transpose(Hidden);
let weight_ho_deltas = Matrix.multiply(gradients, Hidden_T);
this.weight_ho.add(weight_ho_deltas);
this.obias.add(gradients);

// Calculate the hidden layer errors
let who_t = Matrix.transpose(this.weight_ho);
let Hidden_errors = Matrix.multiply(who_t, output_errors);

// Calculate hidden gradient
let Hidden_gradient = Matrix.map(Hidden, this.ActFunc.dfunc);
Hidden_gradient.multiply(Hidden_errors);
Hidden_gradient.multiply(this.LearningRate);


// Calculate deltas
let hidden_T = Matrix.transpose(hidden);
let weight_hh_deltas = Matrix.multiply(Hidden_gradient, hidden_T);
this.weight_hh.add(weight_hh_deltas);
this.Hbias.add(Hidden_gradient);

// Calculate the hidden layer errors
let whh_t = Matrix.transpose(this.weight_hh);
let hidden_errors = Matrix.multiply(whh_t, output_errors);
```

# sketch.js

sketch.js

```
    // Calculate deltas
    let hidden_T = Matrix.transpose(hidden);
    let weight_hh_deltas = Matrix.multiply(Hidden_gradient, hidden_T);
    this.weight_hh.add(weight_hh_deltas);
    this.Hbias.add(Hidden_gradient);

    // Calculate the hidden layer errors
    let whh_t = Matrix.transpose(this.weight_hh);
    let hidden_errors = Matrix.multiply(whh_t, output_errors);

    // Calculate hidden gradient
    let hidden_gradient = Matrix.map(hidden, this.ActFunc.dfunc);
    hidden_gradient.multiply(hidden_errors);
    hidden_gradient.multiply(this.LearningRate);

    // Calcuate input->hidden deltas
    let inputs_T = Matrix.transpose(inputs);
    let weight_ih_deltas = Matrix.multiply(hidden_gradient, inputs_T);

    this.weight_ih.add(weight_ih_deltas);
    this.hbias.add(hidden_gradient);


    $("#w1").val(this.weight_ih.data[0][0].toFixed(4));
    $("#w2").val(this.weight_ih.data[0][1].toFixed(4));
    $("#w3").val(this.weight_ih.data[1][0].toFixed(4));
    $("#w4").val(this.weight_ih.data[1][1].toFixed(4));
    $("#w5").val(this.weight_hh.data[0][0].toFixed(4));
    $("#w6").val(this.weight_hh.data[0][1].toFixed(4));
    $("#w7").val(this.weight_ho.data[0][0].toFixed(4));

    return output_errors.toArray();
}
```

# Run index.html




$w_1 = 0.2$
$w_2 = -0.3$
$w_3 = 0.15$
$w_4 = -0.5$
$w_5 = -0.4$
$w_6 = 0.3$
$w_7 = 0.25$
$b_1 = 1\ (in\ h_1 \& h_2)$
$b_2 = 0.5\ (in\ h_3)$
$b_3 = 1\ (in\ T)$

Learning Rate

0.1

Epoch

200

START

Output

0.9799

MSE

0.0101 %

Elapsed Time

0.544 seconds

W1

0.2522

W2

-0.1955

W3

0.2643

W4

-0.2715

W5

0.7044

W6

1.5971

W7

1.4512

Submit tugas via email :

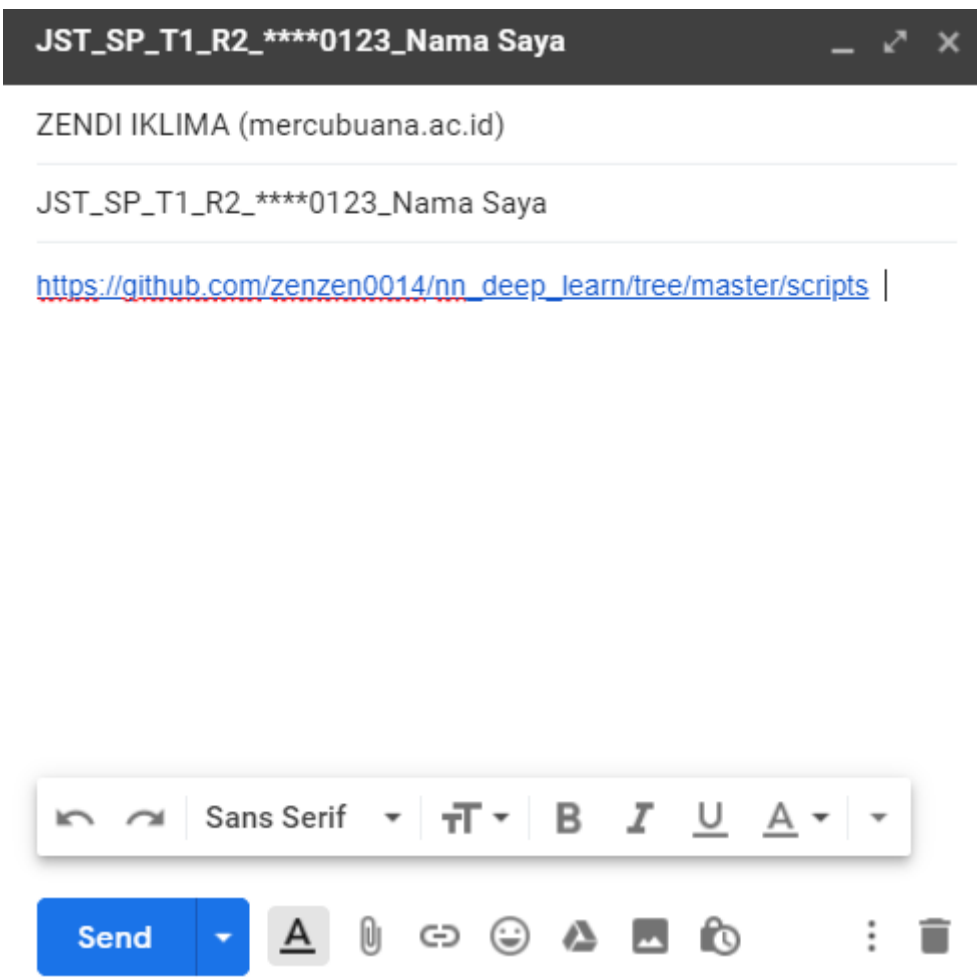
**zendi.Iklima@mercubuana.ac.id**

Dengan menyertakan link github dan Screenshoot hasil running index.html anda masing-masing dengan mail subject:

**JST_SP_T1_R2_NIM_NAMA**

Paling lambat **Sabtu, 24 Agustus 2019 23:59**

*Contoh pengiriman email*



# QUIZ 1

Buatlah sebuah system untuk memprediksi besarnya tegangan pada rangkaian listrik dimana ditentukan oleh 2 variabel input yaitu arus $(i)$ dan hambatan $(R)$ dan 1 variable output yaitu tegangan $(V)$.
Silahkan anda generate serta bandingkan jika diberikan dataset sebanyak 200 data dan 500 data. Kemudian tentukan MSE pada epoch ke – 2000 dengan nilai $\eta = 0.05$ dan $\eta = 0.25$
(*arsitektur neural netwok, weight mengikuti soal UTS*)

Submit QUIZ via email :
**zendi.Iklima@mercubuana.ac.id**
Dengan menyertakan link github dan Screenshoot hasil running index.html anda masing-masing dengan mail subject:
**JST_SP_Q1_R2_NIM_NAMA**
Paling lambat **Minggu, 25 Agustus 2019 23:59**

# FINAL PROJECT

Anda harus menyelesaikan Final Project berupa aplikasi JST dalam Teknik Elektro, dengan tahapan:

1. Menentukan **topik/judul** terkait,
2. Melakukan Literatur Review **minimal 8 jurnal** (Berupa Dokumentasi)
3. **Implementasi** judul terkait berupa **simulasi/aplikasi**
4. Membuat laporan hasil Literatur Review beserta implementasinya. Laporan terdiri dari: **abstrak, pendahuluan, tinjauan pustaka, metode / algoritma, hasil dan pembahasan, kesimpulan serta daftar pustaka** (template terlampir)
5. Membuat Presentasi (**PPT Saat UAS terjadwal**) max 10 slide, 5 menit / orang.

Mengirimkan semua dokumen ke email (.docx, .pdf, .pptx, others).

**JST_SP_UAS_R2_NIM_NAMA**

Dikirim via email paling lambat **Sabtu, 31 Agustus 2019 23:59**

zendi.Iklima@mercubuana.ac.id
triemaya@gmail.com

# TEMPLATE

# Judul / Topik

Nama
Email
No HP

***Abstrak*— Saat ini ..... (1 paragraf) Nascetur tempus dis fames lectus sodales molestie. Volutpat libero varius suscipit vulputate faucibus adipiscing. Platea ligula eleifend congue est lectus tellus. Aenean nam euismod orci class ac. Facilisis lacus adipiscing laoreet maecenas arcu netus ultricies potenti fringilla.**

***Kata Kunci* — *min 3 kata kunci***

## PENDAHULUAN

Pada abad ini, …. (min 300 kata) Nascetur tempus dis fames lectus sodales molestie. Volutpat libero varius suscipit vulputate faucibus adipiscing. Platea ligula eleifend congue est lectus tellus. Aenean nam euismod orci class ac. Facilisis lacus adipiscing laoreet maecenas arcu netus ultricies potenti fringilla.

## TINJAUAN PUSTAKA

Beberapa penelitian telah dilakukan seperti … (min 300 kata) Nascetur tempus dis fames lectus sodales molestie. Volutpat libero varius suscipit vulputate faucibus adipiscing. Platea ligula eleifend congue est lectus tellus. Aenean nam euismod orci class ac. Facilisis lacus adipiscing laoreet maecenas arcu netus ultricies potenti fringilla.

## METODE

Algoritma yang digunakan adalah …
Nascetur tempus dis fames lectus sodales molestie. Volutpat libero varius suscipit vulputate faucibus adipiscing. Platea ligula eleifend congue est lectus tellus. Aenean nam euismod orci class ac. Facilisis lacus adipiscing laoreet maecenas arcu netus ultricies potenti fringilla.

## HASIL dan PEMBAHASAN

Berdasarkan metode yang telah dibahas pada sub sebelumnya maka, …
Nascetur tempus dis fames lectus sodales molestie. Volutpat libero varius suscipit vulputate faucibus adipiscing. Platea ligula eleifend congue est lectus tellus. Aenean nam euismod orci class ac. Facilisis lacus adipiscing laoreet maecenas arcu netus ultricies potenti fringilla.

## KESIMPULAN

Kesimpulan judul yang diangkat menggunakan metode ML atau DL maka, …
Nascetur tempus dis fames lectus sodales molestie. Volutpat libero varius suscipit vulputate faucibus adipiscing. Platea ligula eleifend congue est lectus tellus. Aenean nam euismod orci class ac. Facilisis lacus adipiscing laoreet maecenas arcu netus ultricies potenti fringilla.

## DAFTAR PUSTAKA

[1] A. Adriansyah, Y. Gunardi, B. Badaruddin, and E. Ihsanto, "Goal-seeking Behavior-based Mobile Robot Using Particle Swarm Fuzzy Controller," *TELKOMNIKA (Telecommunication Comput. Electron. Control.*, vol. 13, no. 2, p. 528, 2015.