# Neural Network - First Examples

## Introduction

In these examples we consider a simple neural network, which has to recognize the figures and their characteristics. Every figure has three attributes, represented by three bits.

1. A figure can be a **circle** `[1]` or a **square** `[0]`
2. A figure can be **empty** `[0]` or **full** `[1]`
3. A figure can be **black and white** `[1]` or **colored** `[0]`

## Single attribute correlated with the output (1 to 1)

For the first example, the neural network has to recognize when a figure is a circle, empty/full or color don't matter. Obviously, only one attribute matters to decide the output, but the neural network doesn't know that. In fact, in the network we only have one hidden layer, except the base one with the input data.

| FIGURE | INPUT | | | OUTPUT |
|---|---|---|---|---|
| | CIRCLE | EMPTY | BLACK-WHITE | |
| | 0 | 0 | 1 | 0 |
| | 0 | 1 | 1 | 0 |
| | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | 1 |

## Double attributes correlated with the output (2 to 1)

For the second example, the neural network has to recognize when a figure is an empty circle or a full square, color doesn't matter. Now, the output is provided by the combination of two attributes, this cause the need for a second hidden level, where the inputs are combined.

| FIGURE | INPUT | | | OUTPUT |
|---|---|---|---|---|
| | CIRCLE | EMPTY | BLACK-WHITE | |
| | 0 | 0 | 1 | 0 |
| | 0 | 1 | 1 | 1 |
| | 1 | 0 | 1 | 1 |
| | 1 | 1 | 1 | 0 |