Advance Computer Architecture and x86 ISA
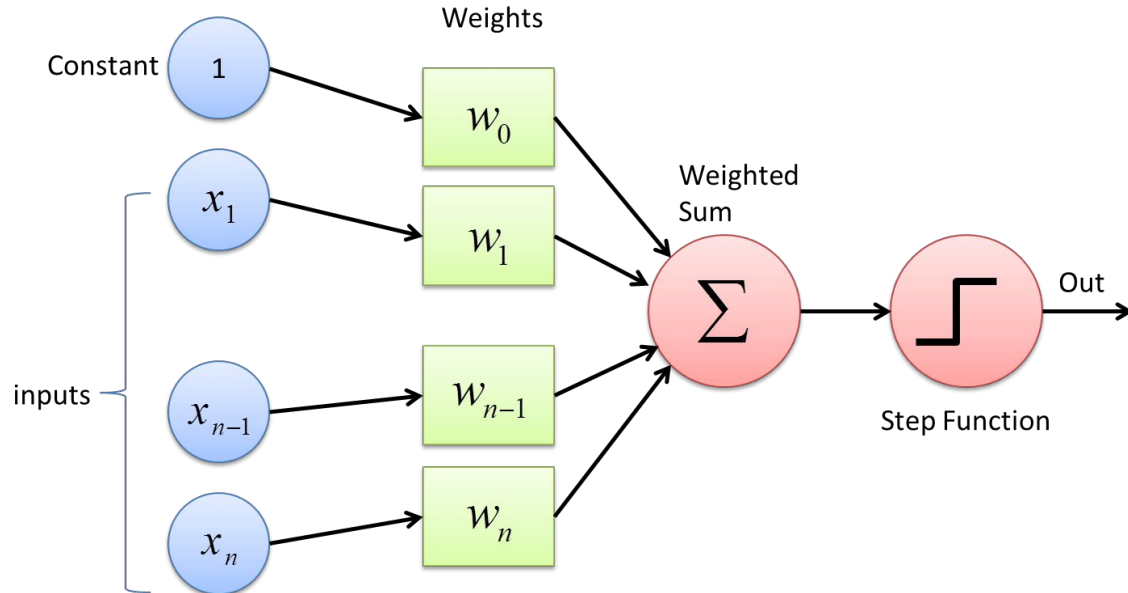
University of Science and Technology of Hanoi

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Midterm Projects
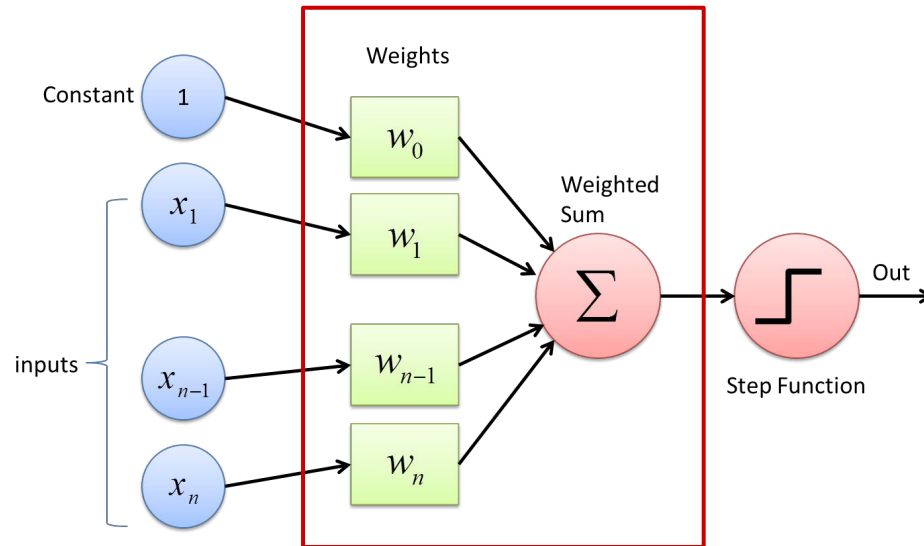
Topics

- Implementation of a perceptron in machine learning context
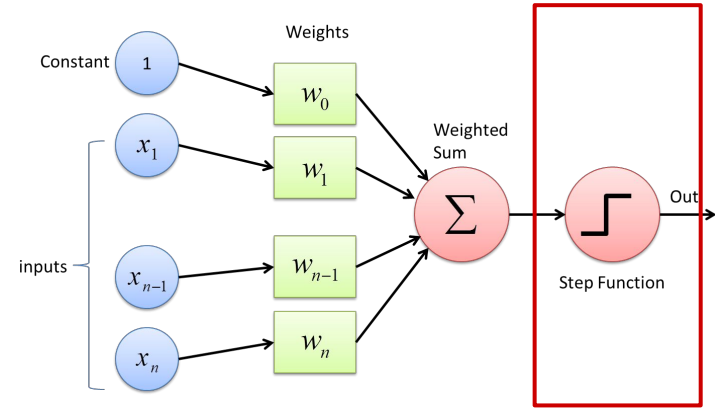
Perceptron: weighted sum

- Calculation

$$\text{out}_1 = w_0 \; + \; x_1 w_1 + \ldots + x_{n-1} w_{n-1} \; + \; x_n w_n$$
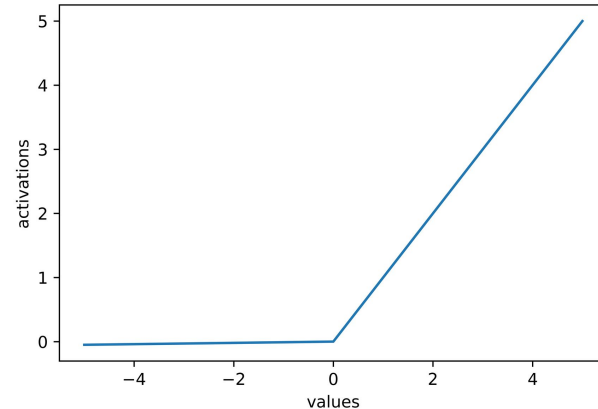

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Perceptron: Step Function

- Calculation

$$\text{out}_2 = f\left(\text{out}_1\right)$$

- Function (ReLU)

$$f\left(x\right) = \begin{cases} x & \text{if } x > 0 \\ 0 & otherwise \end{cases}$$

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Todo Work

Tasks

- Step 1:
    - Write assembly code of Perceptron algorithm
    - Test the code with JSimVEM simulator tool
    - Note the results produce by this code
- Step 2:
    - Load the same code to JSimRisc
    - Configure the processor with 6 pipeline stages
    - Analyze how many cycles are saved with the bypass technique
    - Analyze where are the main problem in the code
    - Data dependencies

Tasks (cont.)

- Step 3:
  - Load the same code in JSimRisc
  - Configure the processor with 8 pipeline stages
  - Analyze how many cycles are saved with the bypass technique
  - Conclusion about the bypass technique
- Step 4:
  - For 6 pipeline stages
  - Explain which technique for branch instructions could be interesting
  - Test static and dynamic prediction

Tasks (cont.)

- Step 5:
  - For 6 pipeline stages
  - If the delayed branch technique is selected, what much be done before executing the code ?
  - Without optimization, how many cycles are necessary with this technique ?
  - Try to optimize the code, to reduce the number of cycles

- Step 6:
  - For 6 pipeline stages
  - Extract the data memory accesses with JSimRisc
  - Use the cache simulator to see the memory access trace
  - With a cache size of 64 elements, try different cache configurations
  - Try to find the best cache configuration, and explain your choice

Requirements & Submission

Requirements & Submission

- Requirements
  - Work in individual
  - Provide executable code
  - Provide report describes
    - Your implementation
    - Your input and output mechanism
    - Answer of all todo work
- Submission
  - **Deadline: 15/05/2024**
  - Push all required files to a directory
  - Compress the directory to a file with name "<STUDENT_ID>-<STUDENT_NAME>-midterm.zip"
  - Submit zip file to USTH Moodle

Thank you for you listening