



**Retele neuronale – Notiuni introductive**  
**COORDONATOR: Prof. Dr. Ing. Virgil Tiponuț**  
**Doctorand: Ing. Alin Brîndușescu**



# **Retele neuronale**

Structura rețelei



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- Unitati functionale
- Arhitectura
- Functionare
- Invatare

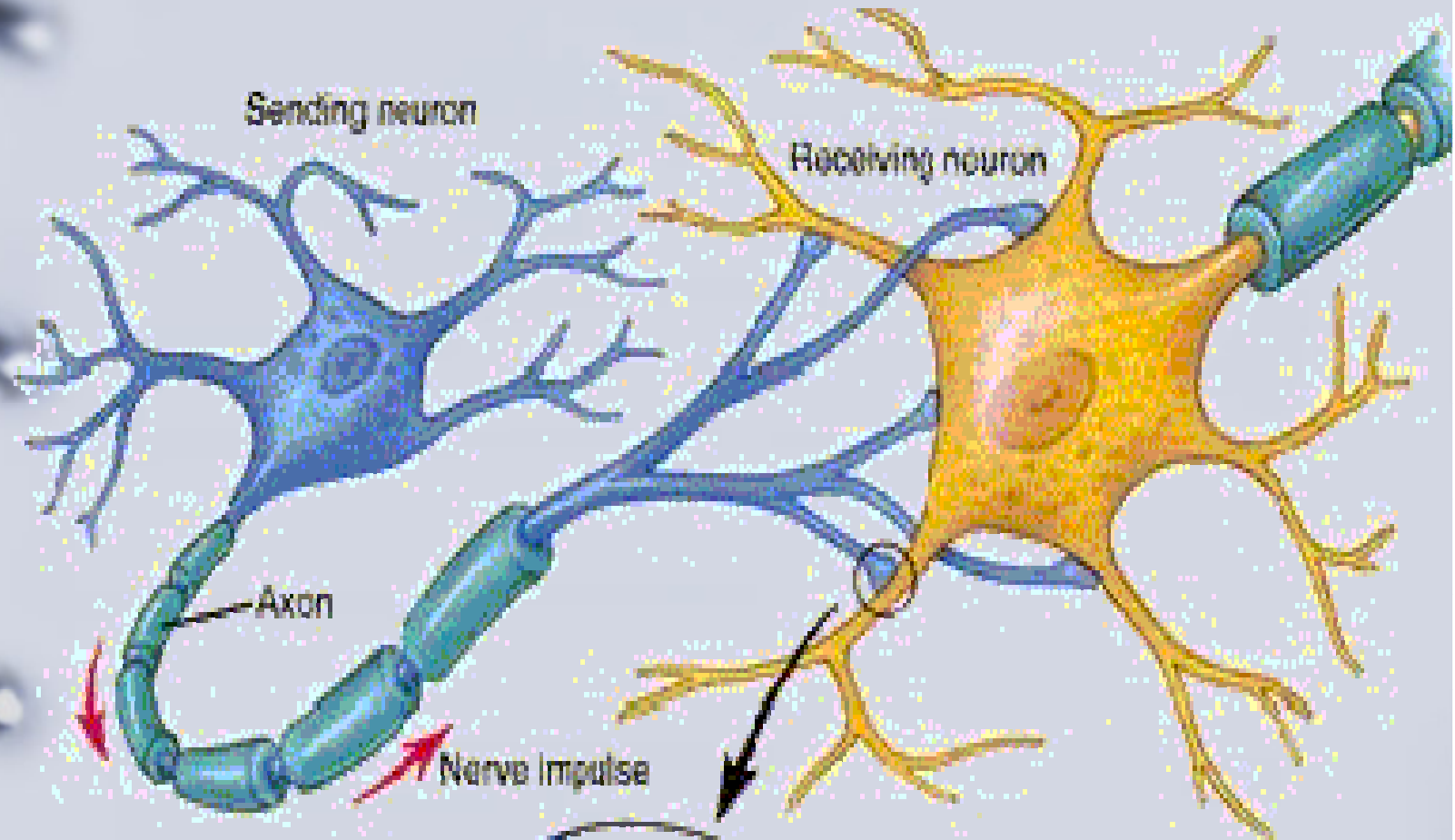




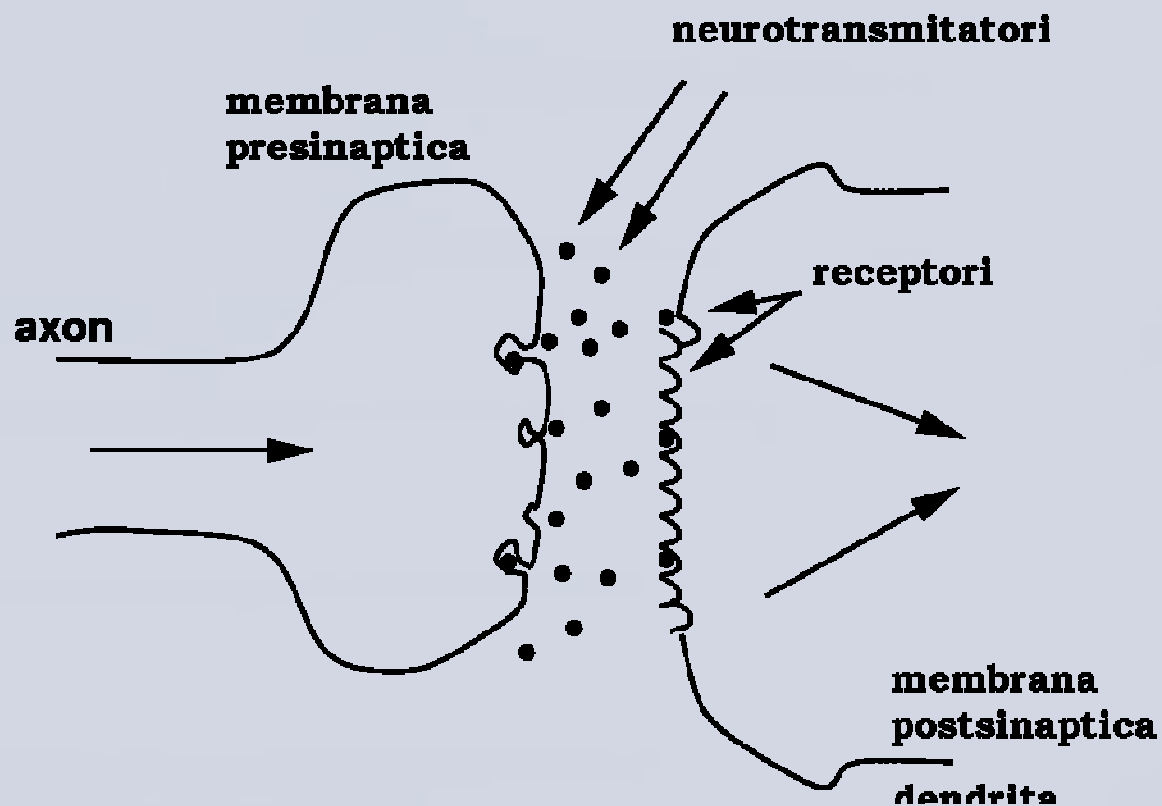
- **Unitati functionale**
  - Modelul neuronului biologic
    - Structura
      - Axon
      - Dendrite
    - Functionare
      - Sinapse
      - Transmitator
      - Potential de actiune (PA)



- **Modelul neuronului biologic**



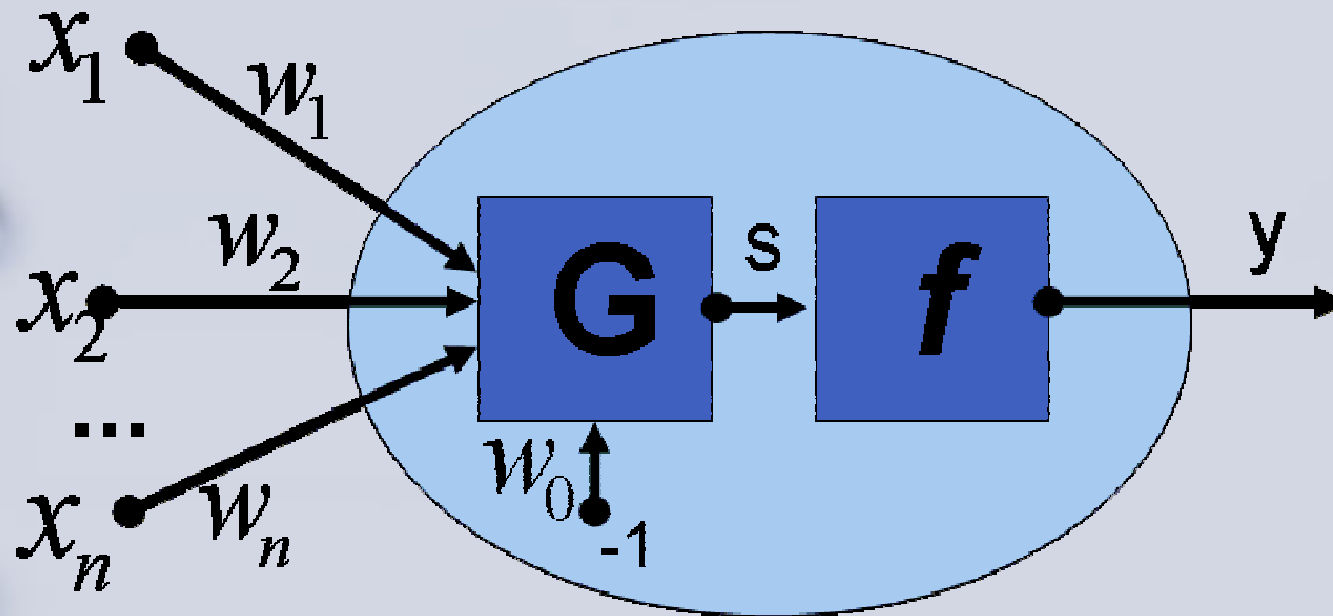
- **Modelul neuronului biologic (cont)**  
**Sinapsa**





- **Unitati functionale**
  - Modelul neuronului functional
    - Ponderi
    - Functia de integrare
    - Functia de transfer
    - Tipuri de unitati
      - Intrare
      - Iesire
      - Ascunse

- Modelul neuronului functional





- daca functia de integrare,  $G$ , combinatie liniara intre parametri de intrare si ponderile asociate:

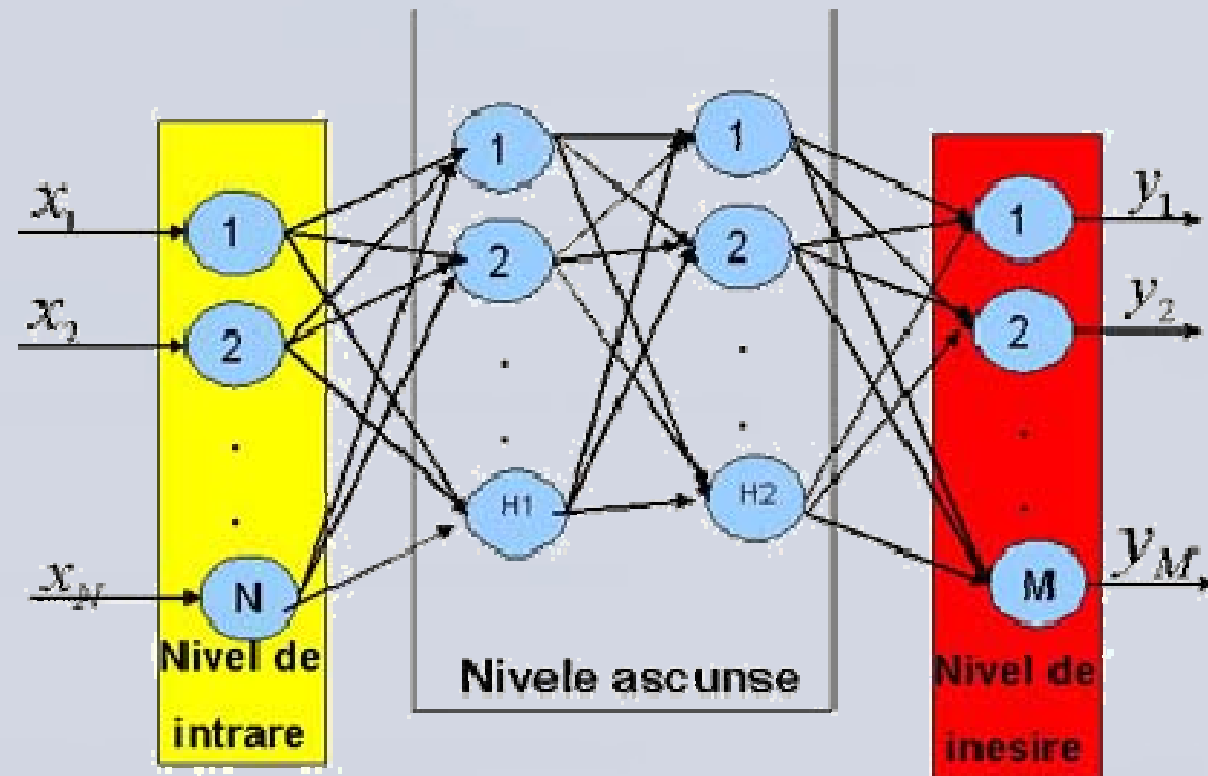
$$y = f \left( \sum_{i=1}^N w_i x_i - w_0 \right)$$



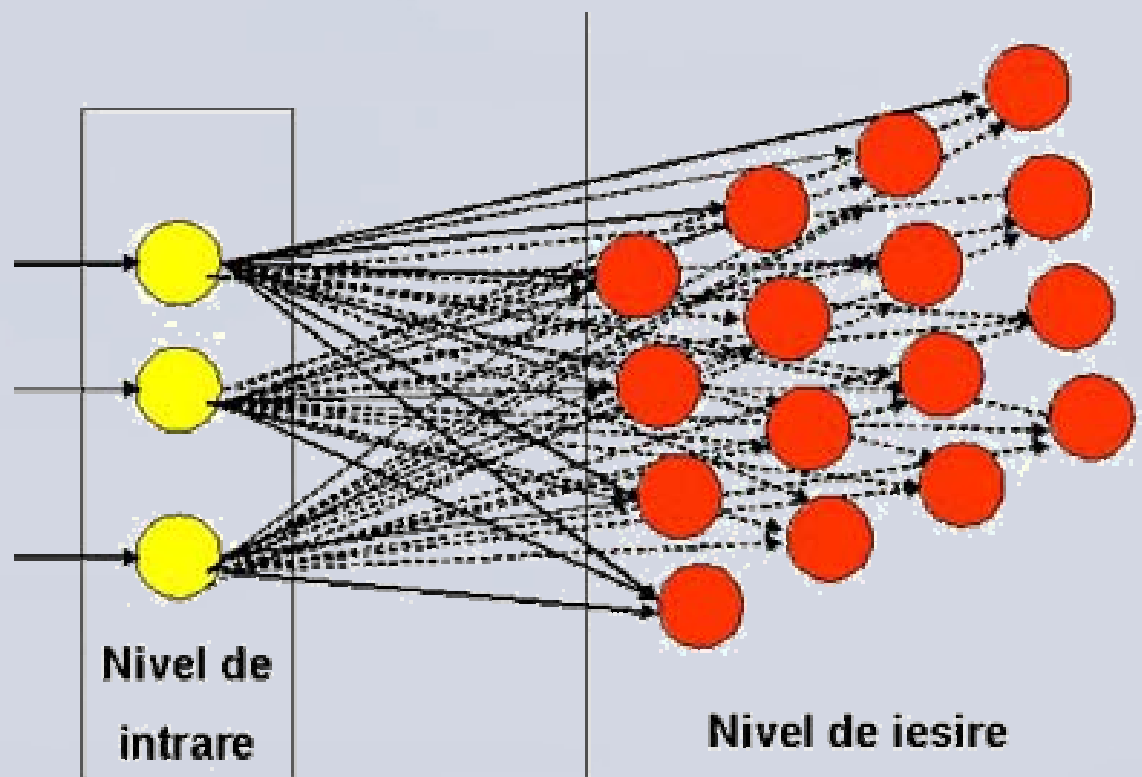


- **Arhitectura**
  - **Topologie**
    - arbitrara
    - pe nivele
    - geometrica
  - **Conexiuni**
  - **Flux informational**
    - Feed-forward
    - Feed-back

- Topologie pe nivele



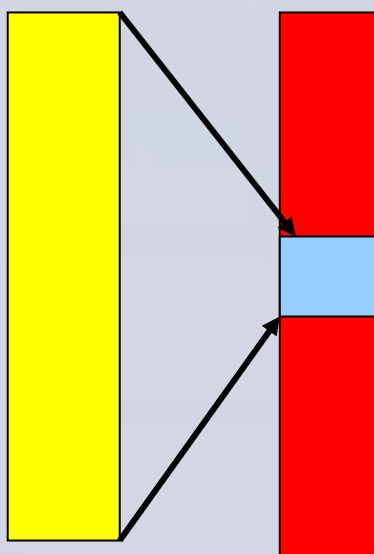
- Topologie cu structura geometrica



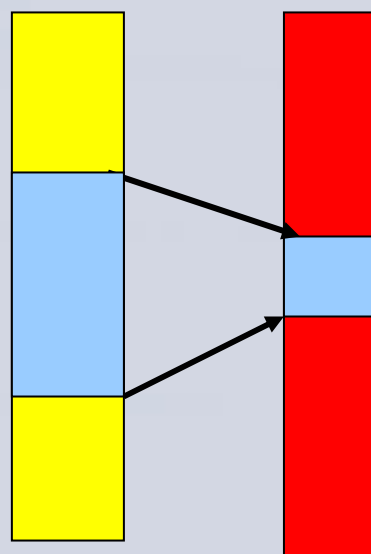


- Conectivitate

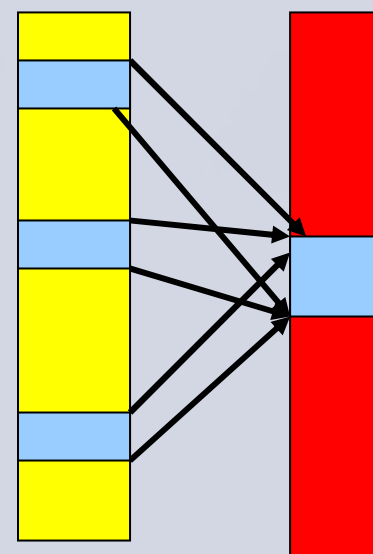
**Totala**



**Locala**



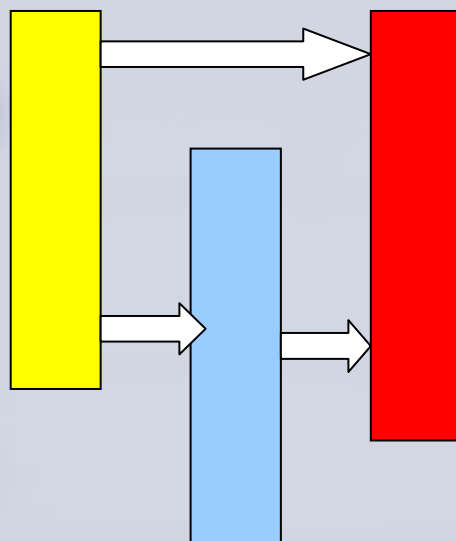
**Partiala**



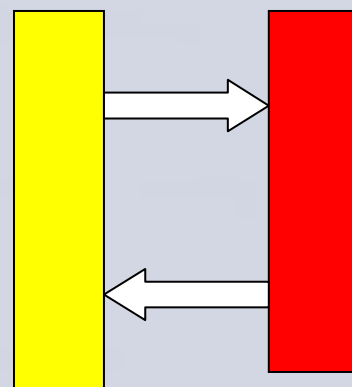


- Conectivitate (cont)

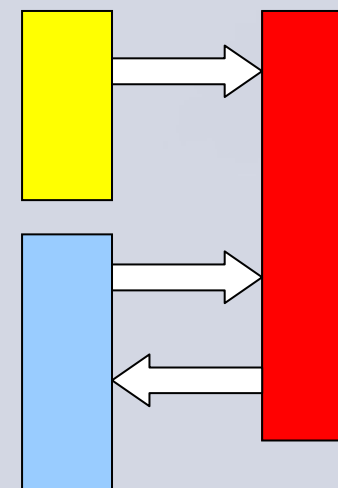
**Peste  
nivele**



**Bidirecionala**



**Hibrida**





- **Functionare**

- **neiterativa**

- caracteristica rețelelor de tip feed-forward
    - $out = F_w(input)$

- **iterativa**

- caracteristica rețelor recurente
    - $X(0) = X, X(t+1) = F_w(X(t)), t \geq 0$

iesirea se considera limita

$$X^* = \lim_{t \rightarrow \infty} X(t)$$

practic se aproximeaza prin  $X(T)$ ,

T - momentul de oprire al procesului iterativ



- Invatare
  - Supervizata
    - set de antrenare
    - testarea
    - suprainvatarea
  - Nesupervizata
    - trasaturi statistice



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# ¿Intrebari?

