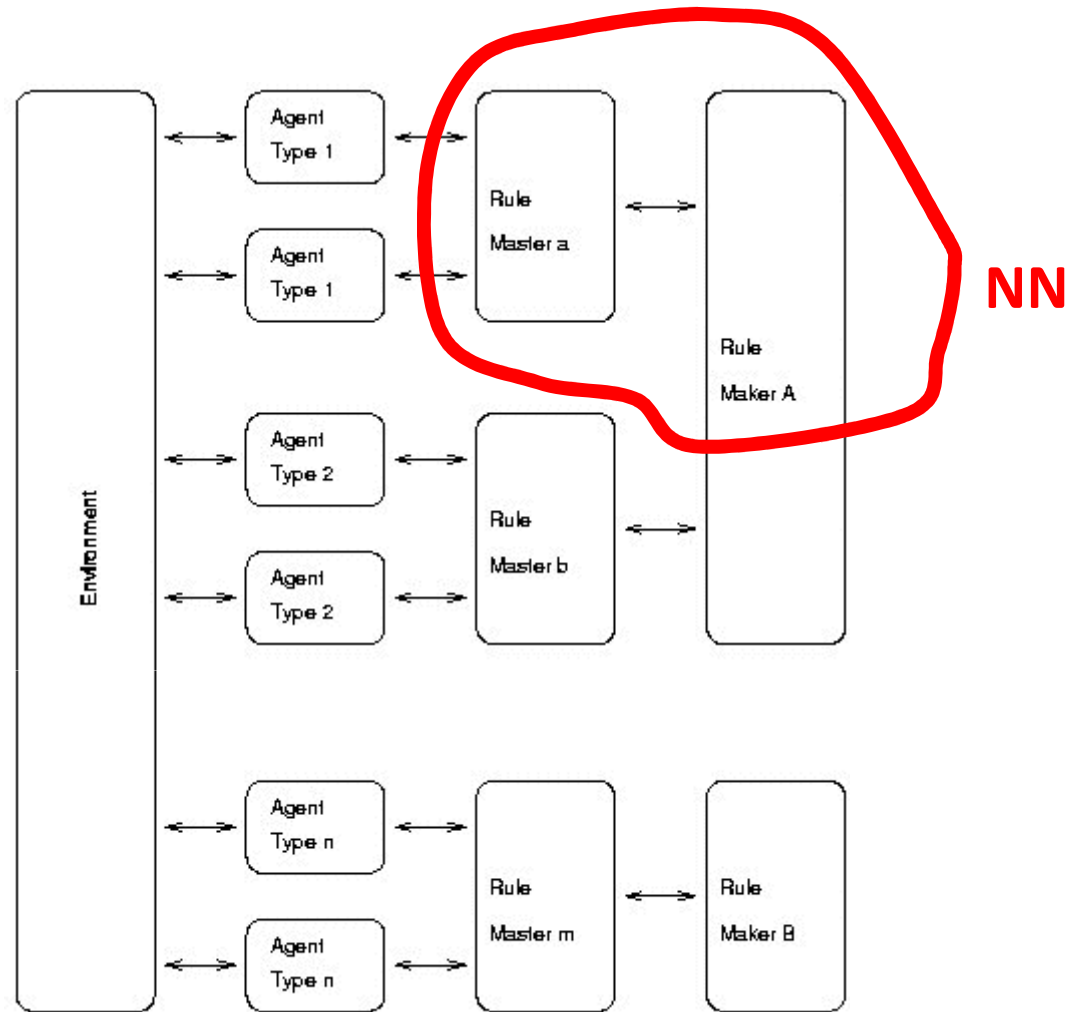




ANN in ABMs



<http://web.econ.unito.it/terna/ct-era/ct-era.html>



The plausibility problem

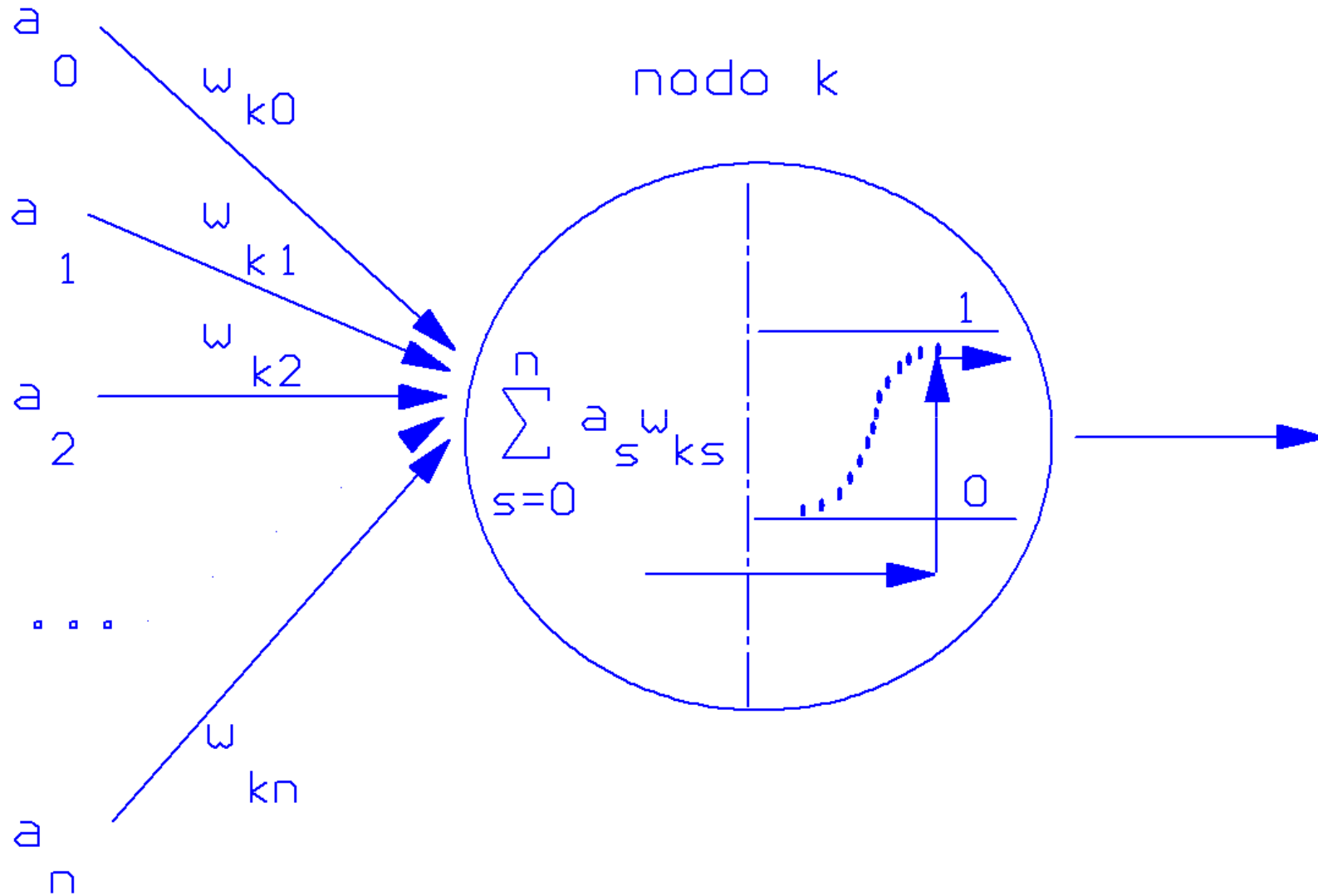


Zorzi M. (2006), *Dai neuroni al comportamento: la simulazione dei processi cognitivi con modelli generativi*. Sistemi Intelligenti, XVIII, 1, pp.115-124.

- (My synthesis). **Connectionist models are highly useful** in studying and simulating human behavior, both in a quantitative and qualitative perspective.
- Anyway, those models are, at present, **intrinsically implausible, both for the neural architectures implemented, both for the use of the error backpropagation (BP) mechanism** used to calculate the network parameters (weights).
- Generally the problem is simply ignored, considering that the BP algorithm is contemporary simple and powerful, but... besides the lack of plausibility **we have to overcome the ex ante data trap**: BP needs output vectors of data as teachers, to apply the so called learning or, in more simple term, the parameters-weights calculation.



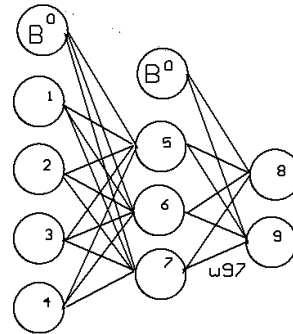
ANN as a modeling tool





Strati

Input Hidden Output



Rete neurale a tre strati

con bias nello strato input e in quello hidden (B)
(con la linea . . . si ricorda che i due nodi bias coincidono di fatto in una sola unita' che e' numerata 0)

4 + 1 nodi input

3 + 1 nodi hidden

2 nodi output

Direzione dei legami

Ogni legame è contraddistinto da un peso w_{ij} in cui i è il nodo destinazione e j il nodo provenienza, ad esempio w_{97}

$$A = \begin{array}{|c|c|c|} \hline w_{50} & w_{60} & w_{70} \\ \hline w_{51} & w_{61} & w_{71} \\ \hline w_{52} & w_{62} & w_{72} \\ \hline w_{53} & w_{63} & w_{73} \\ \hline w_{54} & w_{64} & w_{74} \\ \hline \end{array}$$

$$B = \begin{array}{|c|c|} \hline w_{80} & w_{90} \\ \hline w_{85} & w_{95} \\ \hline w_{86} & w_{96} \\ \hline w_{87} & w_{97} \\ \hline \end{array}$$

With $f(x) = 1/(1 + e^{-x})$ we can write:

$$y = f(B [1, f(A [1, x])])$$

where $y = [y_8 y_9]'$ is the output vector and

$x = [x_1 x_2 x_3 x_4]'$ is the input vector; the constant 1 is added as first element of the vector as input values for the so called bias knots or neurons



$$y = f(B f(A x))$$

Considering the error $E = \sum (t_k - y_k)^2$ we now
calculate the correction

of each w_{ij} parameter

following a set of (x, y) statistics

...

so again the lack of plausibility emerges



Cross Targets (CTs)



- If we use ANN to build our agents in agent based experiments, we can also introduce the following **general hypothesis (GH)**:
- an agent, acting in an economic environment, must develop and adapt her capability of evaluating, in a coherent way, **(1) what she has to do in order to obtain a specific result and (2) how to foresee the consequences of her actions.**
- The same is true if the agent is interacting with other agents.
- Beyond this kind of internal consistency (IC), agents can develop other characteristics, for example the capability of adopting actions (following external proposals, **EPs**) or evaluations of effects (following external objectives, **EOs**) suggested from the environment (for example, following rules) or from other agents (for examples, imitating them).
- Those additional characteristics are useful for a better tuning of the agents in making experiments.



CTs

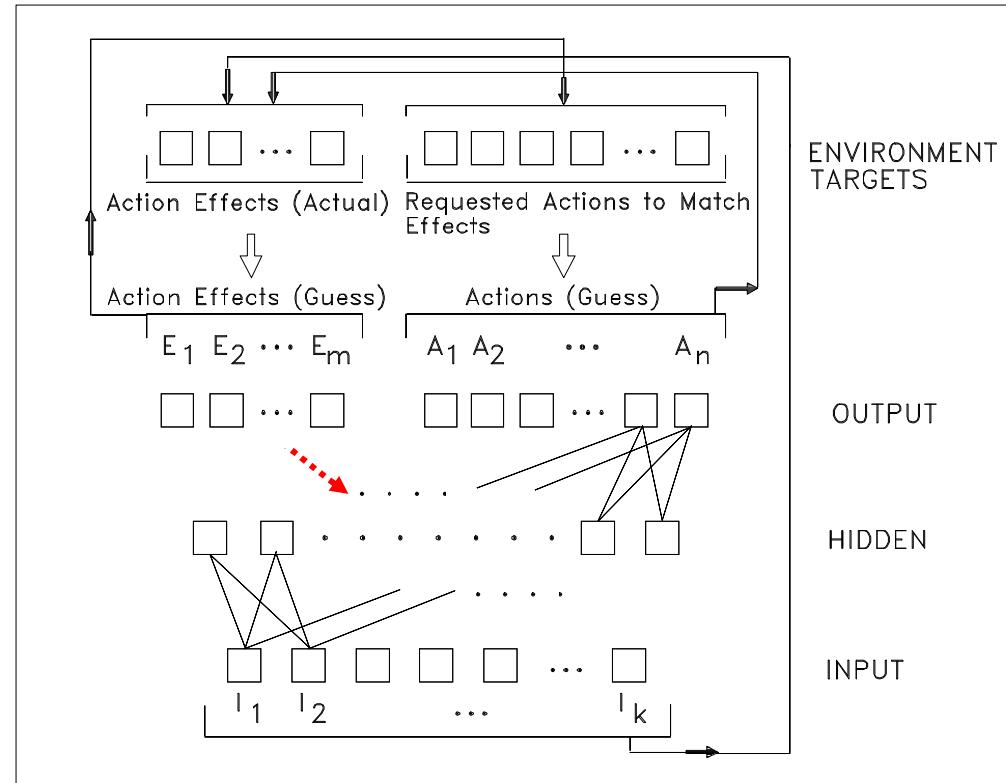
- **The name cross-targets (CTs)** comes from the technique used to figure out the targets necessary to train the ANNs representing the artificial adaptive agents (AAAs) that populate our experiments.
- Following the GH, the main characteristic of these AAAs is that of **developing internal consistency between what to do and the related consequences.**
- Always according to the GH, in many (economic) situations, the behavior of agents produces evaluations that can be split in two parts: data quantifying actions (what to do) and forecasts of the outcomes of those actions. So we specify two types of outputs of the ANN and, identically, of the AAA: (i) actions to be performed and (ii) guesses about the effects of those actions.



EOs

EPs

**Short term
learning and long
term learning**



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