Consiglio Nazionale delle Ricerche

Istituto di Scienza e Tecnologie dell'Informazione "A. Faedo"

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Stretch your tentacles, POLPO-Net: a POLymorphic PrObabilistic approach to greedily approximate model uncertainties

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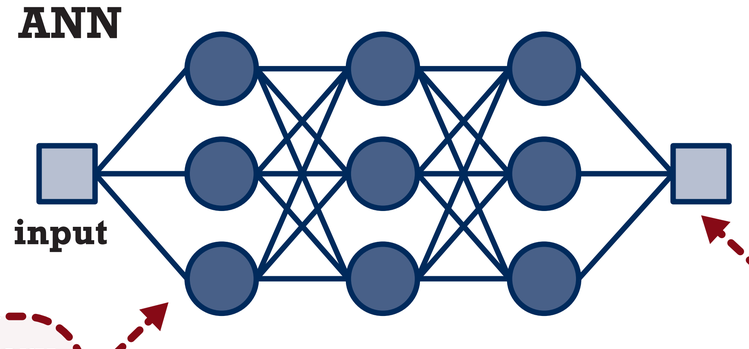
Good networks are (*too*) expensive

These are *a lot* of distributions...

ANN

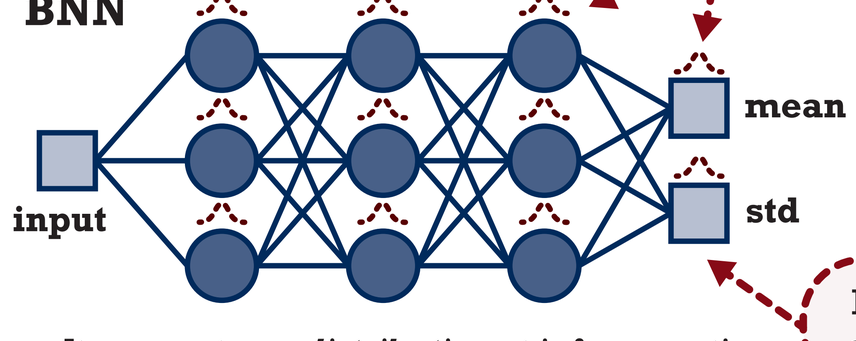


Arbitrary shape

- Well known and *easy to train*
- No *reliable* Reliability Measure
- Definitely quite *boring*!

The last output is NOT a probability

BNN

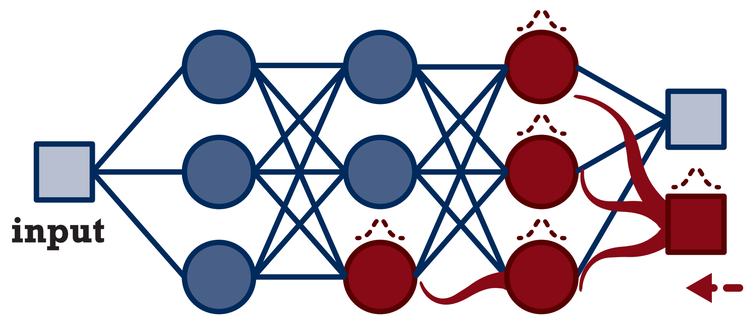


Reliable estimates

- It generates a *distribution* at inference time
- State-of-the-art *Bayesian Reliability Measure*
- You (almost) *never* have enough data to train it!

Nets are *boring*... let's grow some TENTACLES

Original pre-trained ANN



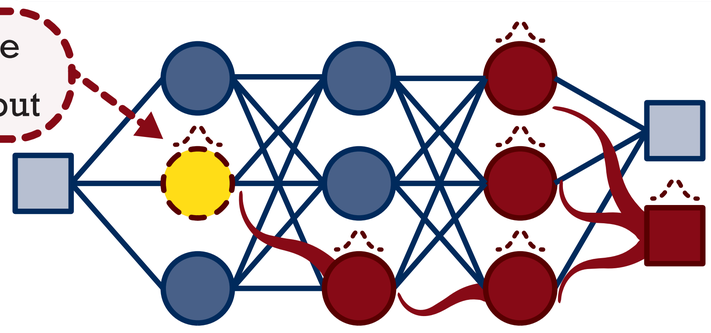
Did you say... **Pr**O**O**babilistic?

POLPO-net

We want to approximate the model uncertainty (i.e., **std**) using a reduced information (collected by tentacles).
POLPO-net is the probabilistic version of the original network on a reduced dimension and learning throughout the *Variational Inference* (on the prediction given by the original ANN) ONLY the std estimate.

Stretch your tentacles...

Tentacle = Extra input



When the network has learned enough from the data, it adds a *new tentacle* to the node that leads to the maximum gradient update.

Iterate greedily until convergence

... but not **that much!!!**

As the network degrades in performance, it reduces the degrees of freedom by properly *pruning* the less useful tentacles.

Changing shape? ... do you mean **POL**ymorphic?

Open-Source release on GIT-Hub

Testing with CINECA resources ***Leonardo***: 5000 hours Class C Project

Compatible with ***PyTorch*** ANN

Testing with an in-house ***synthetic*** dataset: ***NA-DAtabase***

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