

Physics-CS: Nobel Prize Event

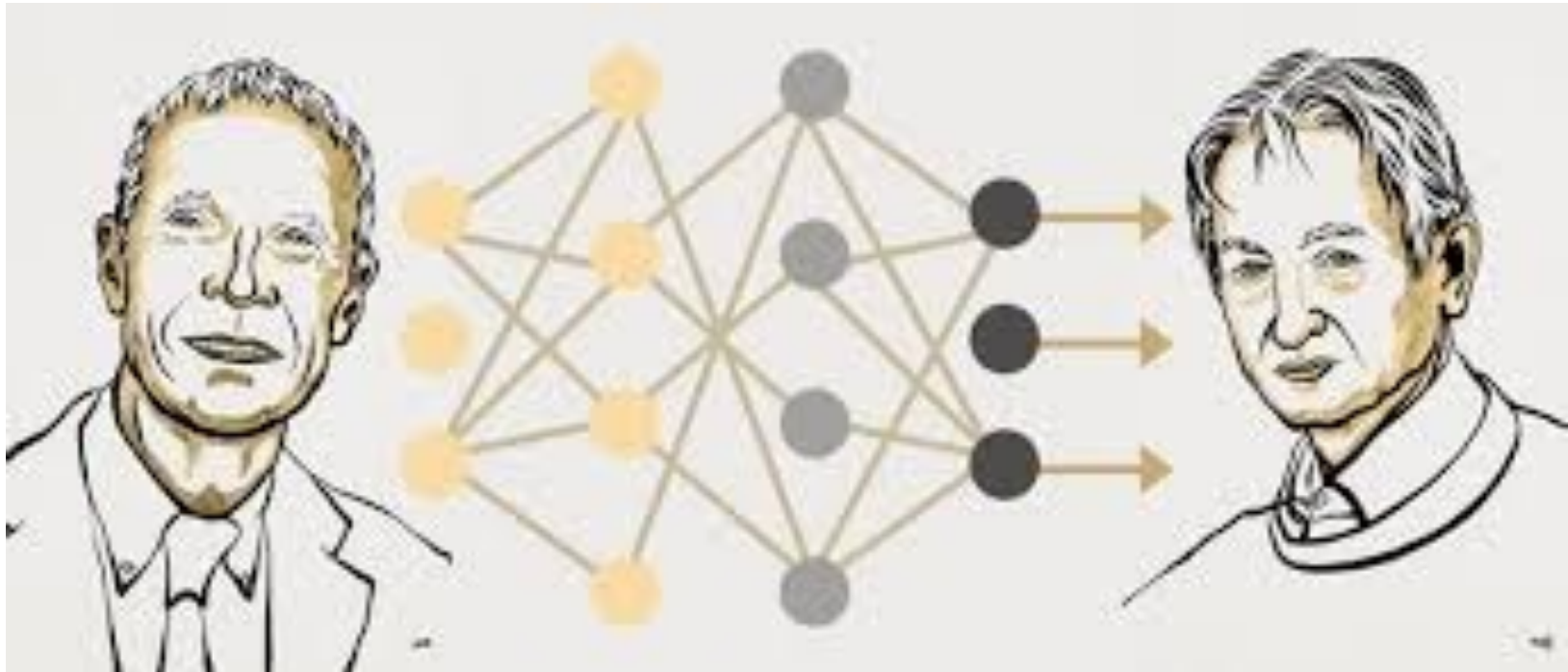
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Please note that all pictures and figures
are from internet!!!

Nobel Prize in Physics 2024



John Hopfield

Geoffrey Hinton

Nobel Prize in Physics 2024

- Geoffrey Hinton
 - Godfather of AI
 - Computer scientist
 - Cognitive scientist
 - Cognitive psychologist
 - Won the Nobel prize in physics,

why???

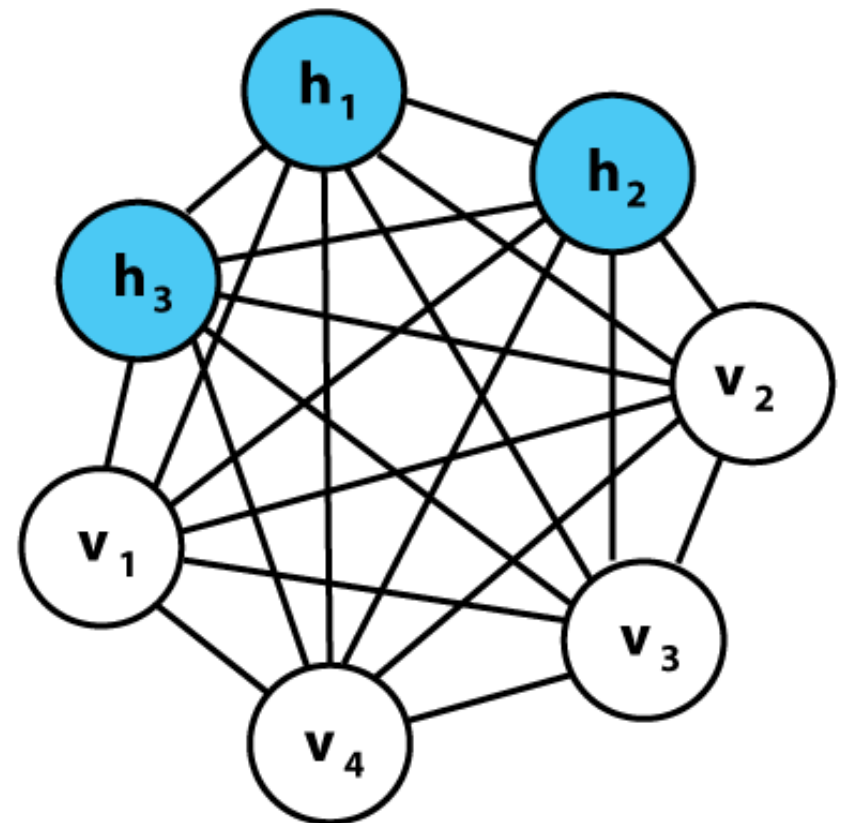
Because the committee gave him a new title: Physicist...

Because of his achievement in AI (artificial Neural Network), specifically in Deep learning, such as **Boltzmann machine**.



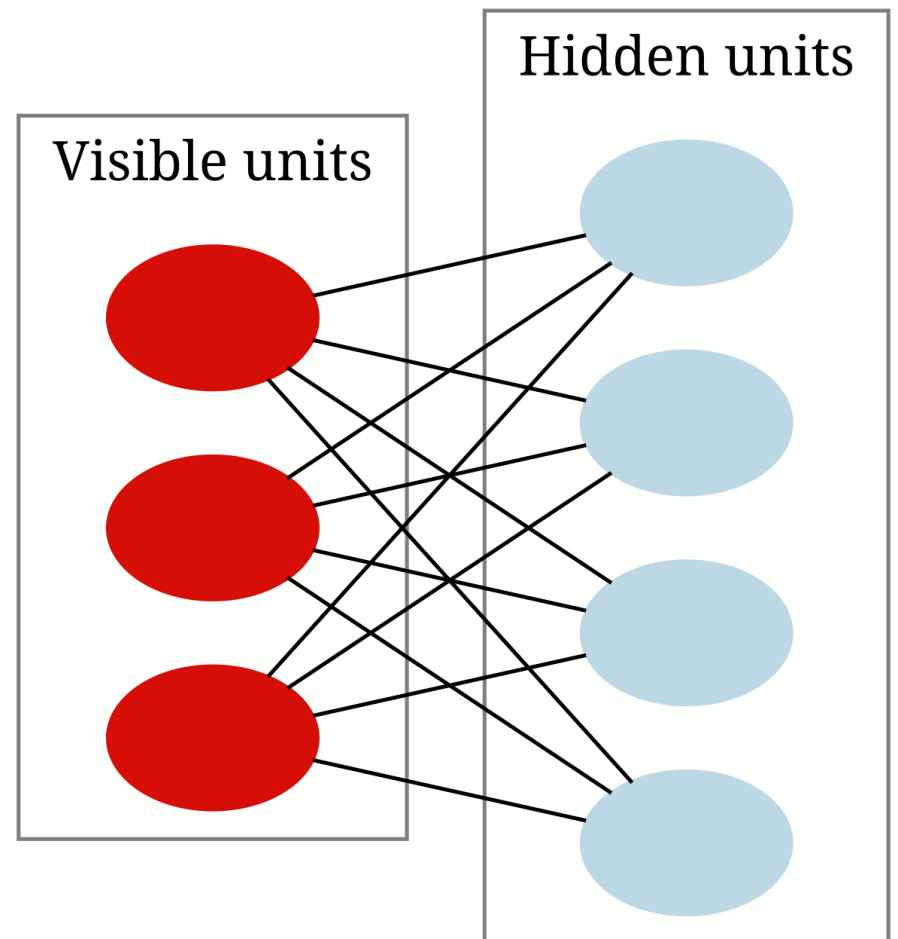
Boltzmann Machine

- Proposed in 1983 by Geoffrey Hinton and Terry Sejnowski
- He named his artificial neural network the Boltzmann machine after the 19th-century **physicist Ludwig Boltzmann**
- He was inspired by Boltzmann's work in statistical mechanics and thermodynamics
- Boltzmann machine uses a similar concept of **energy states and probabilities** to model neural networks



Restricted Boltzmann Machine

- Restricted BM (RBM) in 1985 by Geoffrey Hinton
- RBM is the foundational element in the field of machine learning
- Particularly for tasks involving unsupervised learning and feature extraction
- **Geoffrey Hinton won many awards**
 - ✓ Rumelhart Prize (2001)
 - ✓ IEEE Frank Rosenblatt Award (2014)
 - ✓ James Clerk Maxwell Medal (2016)
 - ✓ Turing Award (2018)
 - ✓ Dickson Prize (2021)
 - ✓ Princess of Asturias Award (2022)



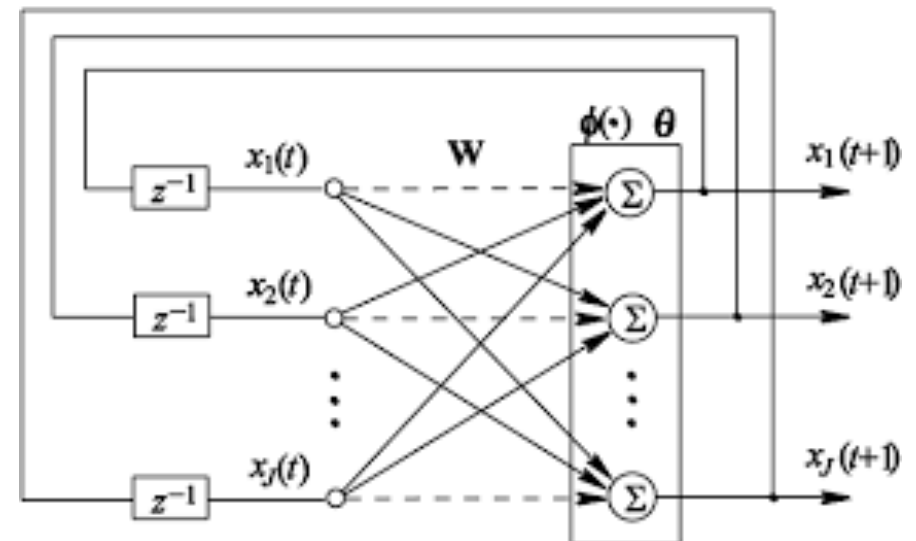
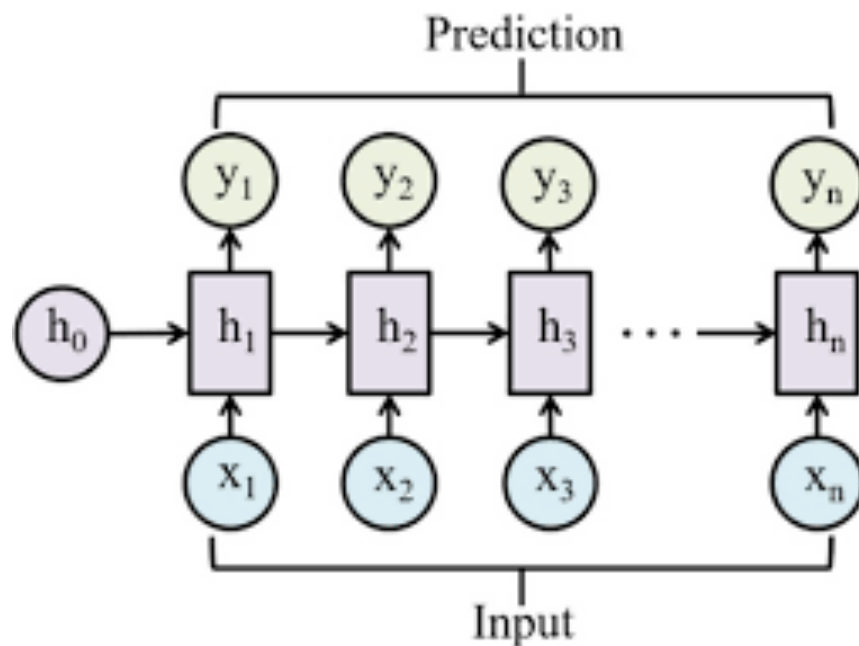
Nobel Prize in Physics 2024

- John Joseph Hopfield
 - Physicist
 - Professor of Princeton University
 - In 1982, Hopfield network (associative neural network)
- John Hopfield won many awards
 - ✓ Oliver E. Buckley Condensed Matter Prize (1969)
 - ✓ Albert Einstein World Award of Science (2005)
 - ✓ Dirac Medal and Prize (2001)
 - ✓ Harold Pender Award (2002)
 - ✓ Benjamin Franklin Medal (2019)
 - ✓ Boltzmann Medal (2022)



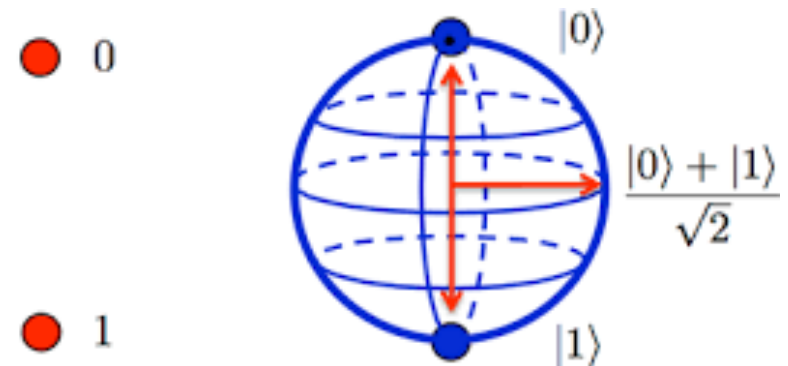
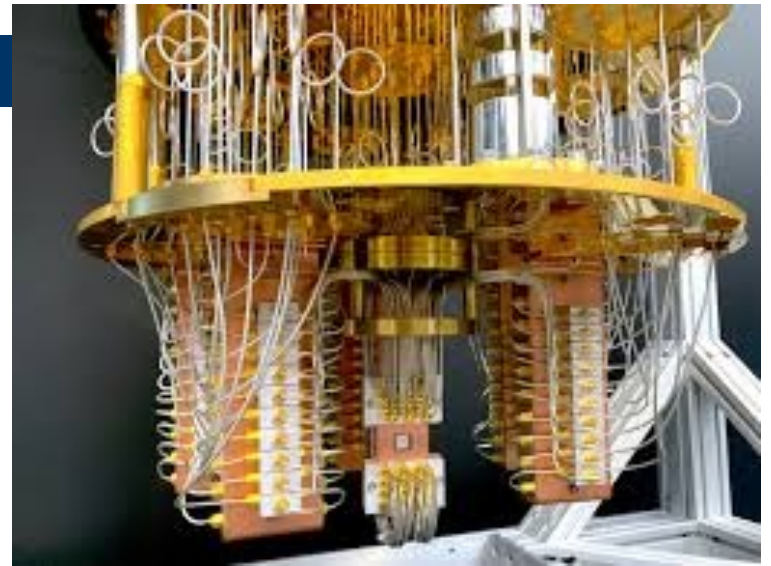
Hopfield Network

- Hopfield network is a form of recurrent neural network



Quantum Machine Learning

- Leverage principles from **quantum physics** to enhance machine learning algorithms
- Solve complex problems more efficiently than classical methods
- E.g., machine learning uses the superposition principle for parallel processing vast amounts of data

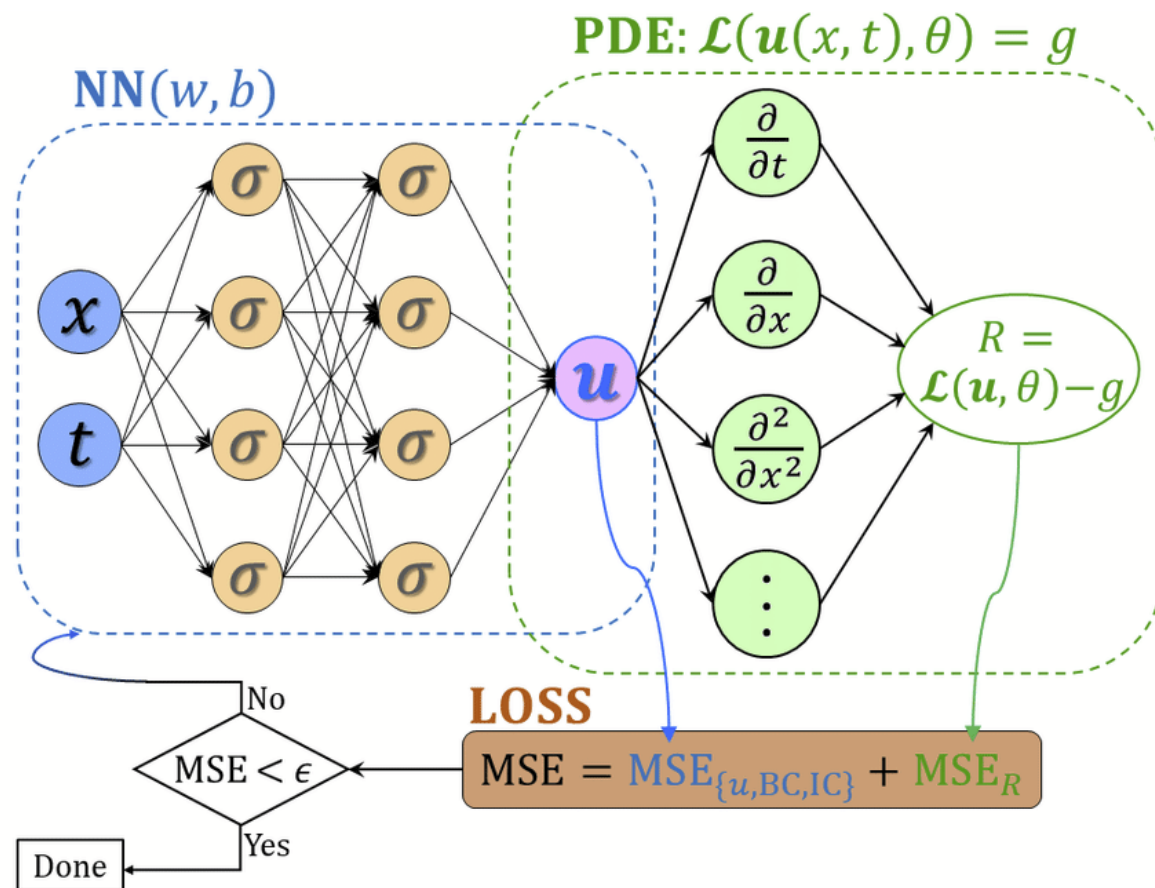


Classical Bit

Qubit

Physics-Informed Neural Networks

- Incorporate physical laws into the training process
- Ensures the models adhere to known physical principles
- Improve the performance of models in related fields



**Thanks! Look for
Collaborations!!**

Q & A?

