

# MACHINE LEARNING HANDS-ON WORKSHOP

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JOINT ICTP-IAEA WORKSHOP ADVANCED SCHOOL ON  
COMPUTATIONAL NUCLEAR SCIENCE

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# PRACTICAL TIPS FOR TRAINING MODELS

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# DATA

	Feature 1	Feature 2	Feature 3	Target
Example 1				
Example 2				
Example 3				
Example 4				



## NORMALIZATION

- Puts each feature on same scale
- Allows default hyperparameters to be a good starting point
  - learning rate, initialization of weights, etc.
- Options depend on data distribution
  - Standardization: mean: 0 stdev: 1
  - Min-max: [0,1]

# DATA

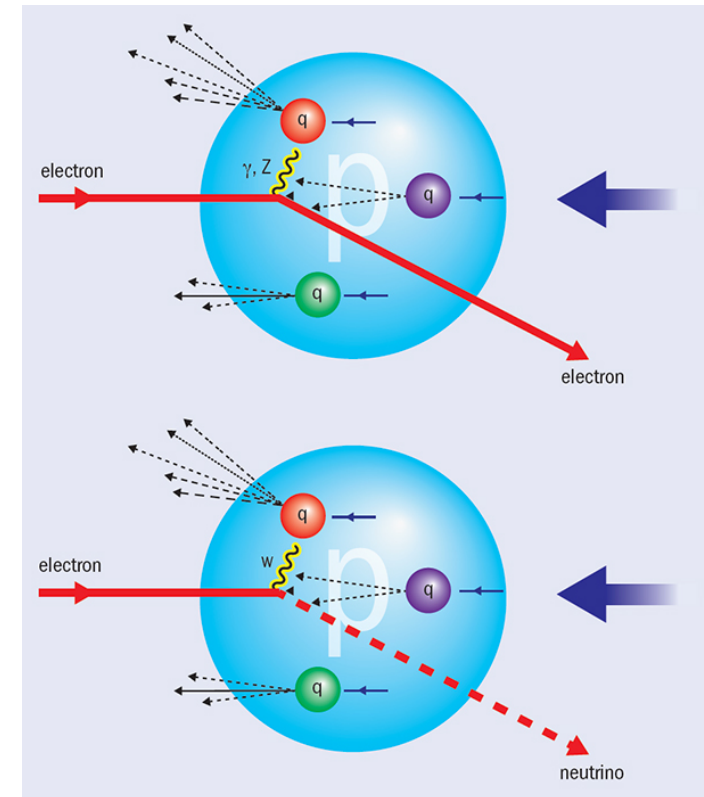
	Feature 1	Feature 2	Feature 3	Target
Example 1				
Example 2				
Example 3				
Example 4				

## ENCODING

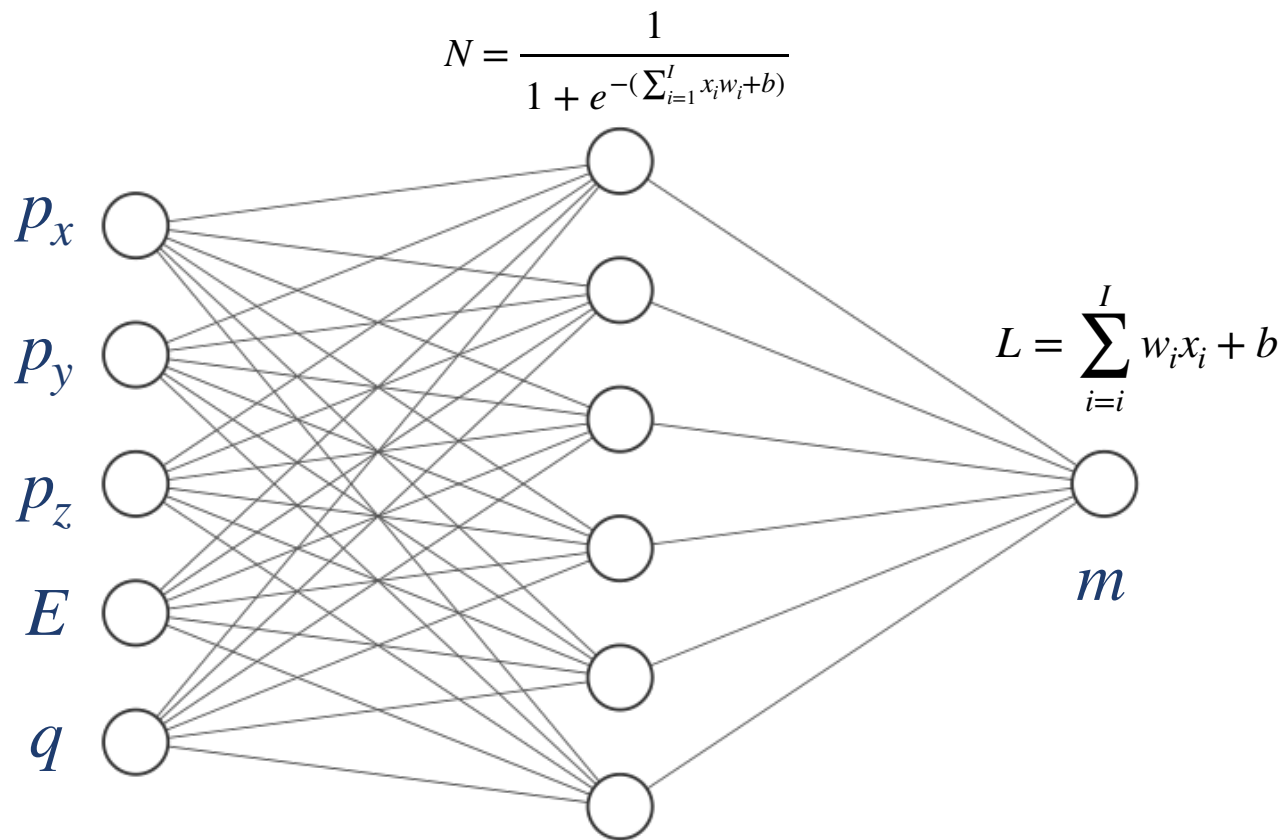
- Non-numeric data
- Class-based features:
  - One-hot encoding:  $2 \rightarrow [0 \ 1]$
  - When classes do not have sequential meaning:  cars vs dogs vs plants  months

# ACTIVITY DESCRIPTION

- Simulating  $e+p$  collisions
- Predicting particle-level invariant mass (regression)
- Advanced: try a generative model (e.g. autoencoders)



# ACTIVITY DESCRIPTION



$$m^2 = E^2 - \|p\|^2$$

- Sigmoid activation for hidden layer and linear for output (regression model)
- How many “trainable parameters” in our model?

# COMMUNITY

- Each of you arrived here with your own backgrounds, specialty, and path in life
  - Your experience and expertise are valuable here, no matter what it is
  - If the activity is within your background, help others!
  - If you are totally (or a little) lost, ask for help!
  - It is our shared goal to have **each** of us leave with some new skill/knowledge/understanding
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# GETTING STARTED

- Click the link under this tutorial on the workshop page
  - If you have access to a google login, click "open in collar"
  - Otherwise, download and open in Deepnote or download onto your personal computer (with appropriate dependencies)
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FRIB

