# Bidirectional Recurrent Neural Networks (BiRNNs)

In Bidirectional Recurrent Neural Networks (BiRNNs), the return\_sequences and return\_state parameters control the output of the network. Here’s what each of these parameters means and what happens when you set them to True or False:

**return\_sequences**

* **False (default)**: The network returns only the output of the last time step. This is often used in tasks where you only care about the final output, such as sequence classification.
* **True**: The network returns the output for every time step. This is useful for tasks where the output at each time step is important, such as in sequence-to-sequence models or when generating sequences.

**return\_state**

* **False (default)**: The network does not return the hidden states.
* **True**: The network returns the hidden states (both forward and backward states in the case of BiRNNs). This is useful when you need the hidden states for further processing, such as when stacking RNNs or in attention mechanisms.

**Detailed Behavior**

1. **return\_sequences=False, return\_state=False**:
   * Output: Final output at the last time step.
   * Shape: (batch\_size, output\_dim)
2. **return\_sequences=True, return\_state=False**:
   * Output: Outputs at all time steps.
   * Shape: (batch\_size, timesteps, output\_dim)
3. **return\_sequences=False, return\_state=True**:
   * Output: Final output at the last time step, final states.
   * Shape: [(batch\_size, output\_dim), (batch\_size, state\_dim)] for unidirectional RNNs and [(batch\_size, output\_dim), (batch\_size, state\_dim), (batch\_size, state\_dim)] for BiRNNs (forward and backward states).
4. **return\_sequences=True, return\_state=True**:
   * Output: Outputs at all time steps, final states.
   * Shape: [(batch\_size, timesteps, output\_dim), (batch\_size, state\_dim)] for unidirectional RNNs and [(batch\_size, timesteps, output\_dim), (batch\_size, state\_dim), (batch\_size, state\_dim)] for BiRNNs (forward and backward states).