6th December (29.11)

Learning, performing and remembering serially ordered actions

Importance of serial order in behaviour

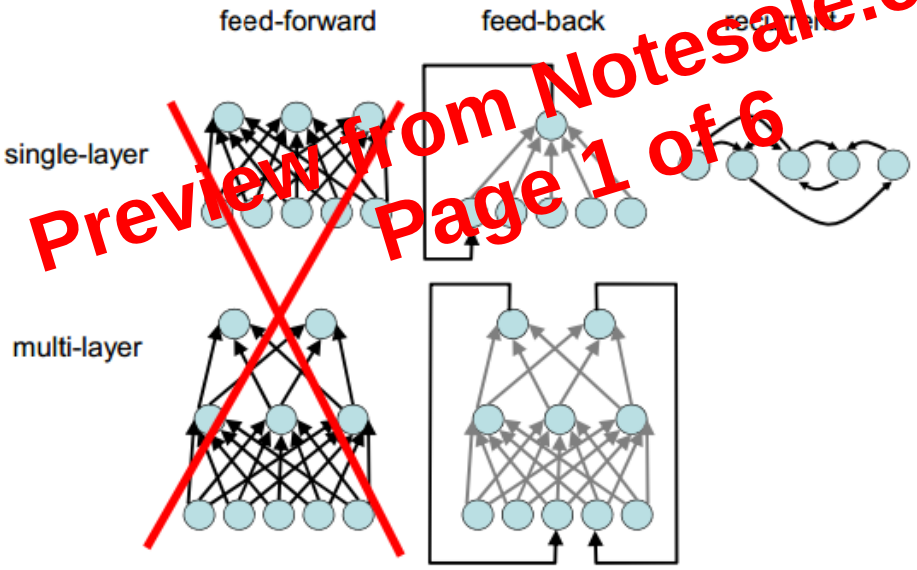
- Motor control
  - Generate correct sequence of muscle contractions to perform actions
- Speech and language
  - Sequence of speech sounds must be produced to say a word
- Executive function
  - High level executive functions, e.g. a sequence of actions must be produced to make a cup of tea

Two ways in which serial learning might be implemented in neural networks

1. **Associative chaining**
   a. Where you make an association from one item to the next item
   b. E.g. this might apply to alphabet learning
2. **Competitive queuing**

Associative chaining

- Requires recurrent/feedback connections
- Or modified serial learning algorithms
- Include asymmetric recurrent connections
- Standard feedforward networks can't produce serial output



- E.g. heartbeat. We want to start the network off somehow and then make it produce sequence of actions.
- Have feedback from output neuron to the input neuron.
- Recurrent connections: more complicated but also cause a series of connections

Static input leads to static output, but if there is feedback, dynamic output occurs. Partially recurrent (feedback) network architectures permit serial learning using standard supervised learning rules (e.g., error back-propagation).

Jordan (1986)