# Course 3, Module 2
# Constructing Features for Prediction

CMPUT 397
Fall 2019

# Plan for today

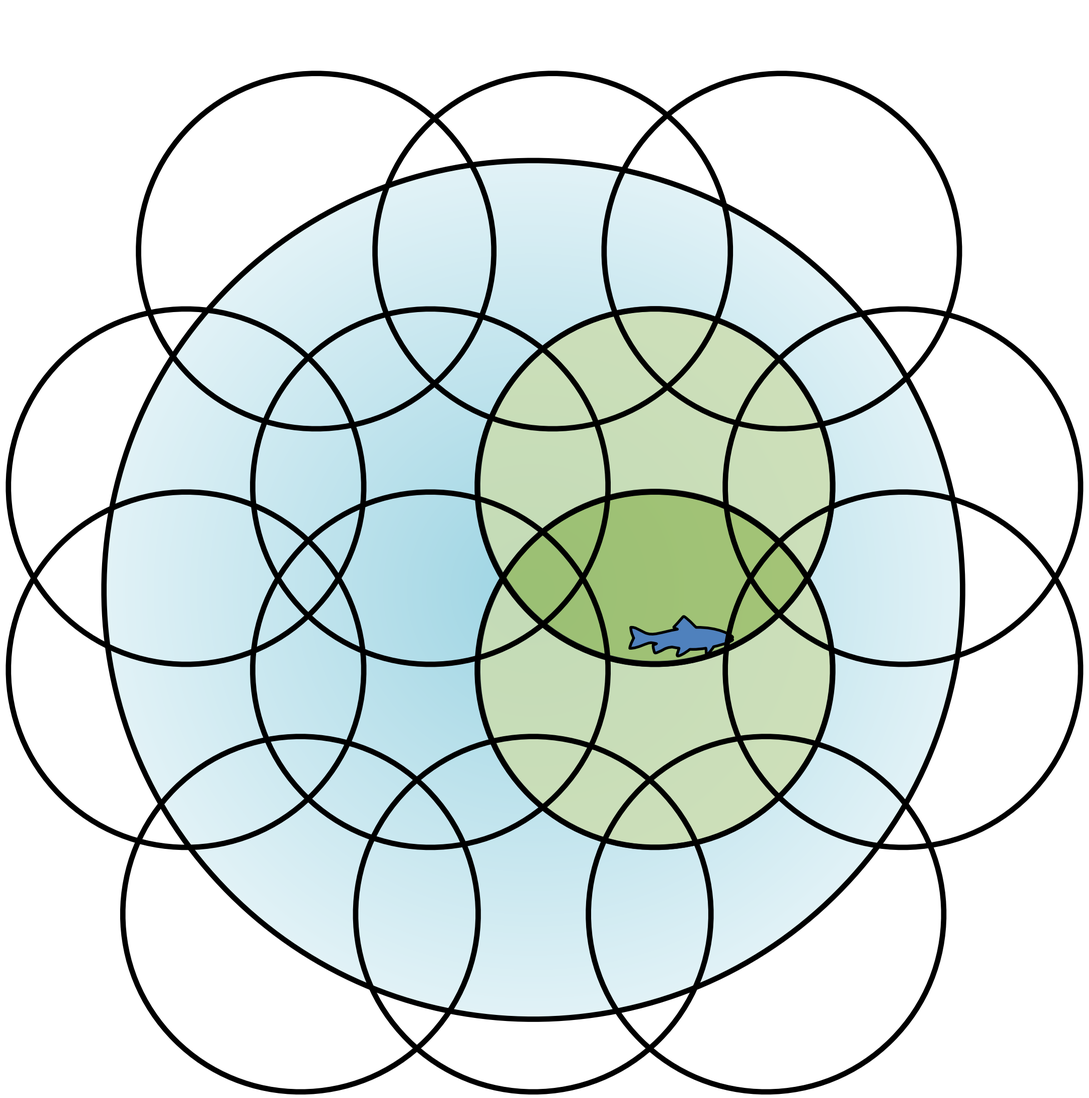
- Midterm overview
- Clarifications about feature construction
- Clarifications about the value error objective

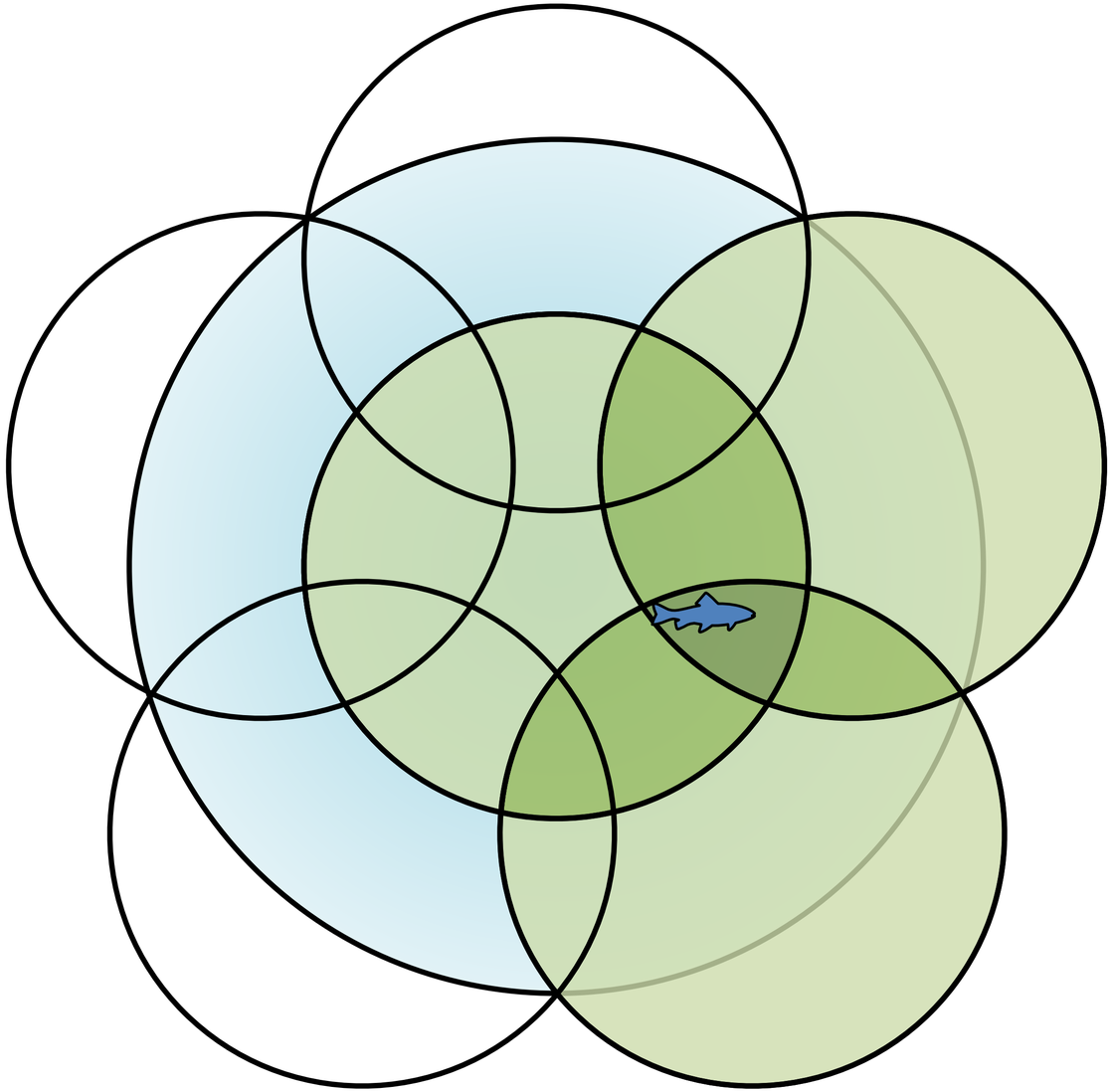
- Link for questions:
  - **http://www.tricider.com/brainstorming/2ZM3oW21vmN**

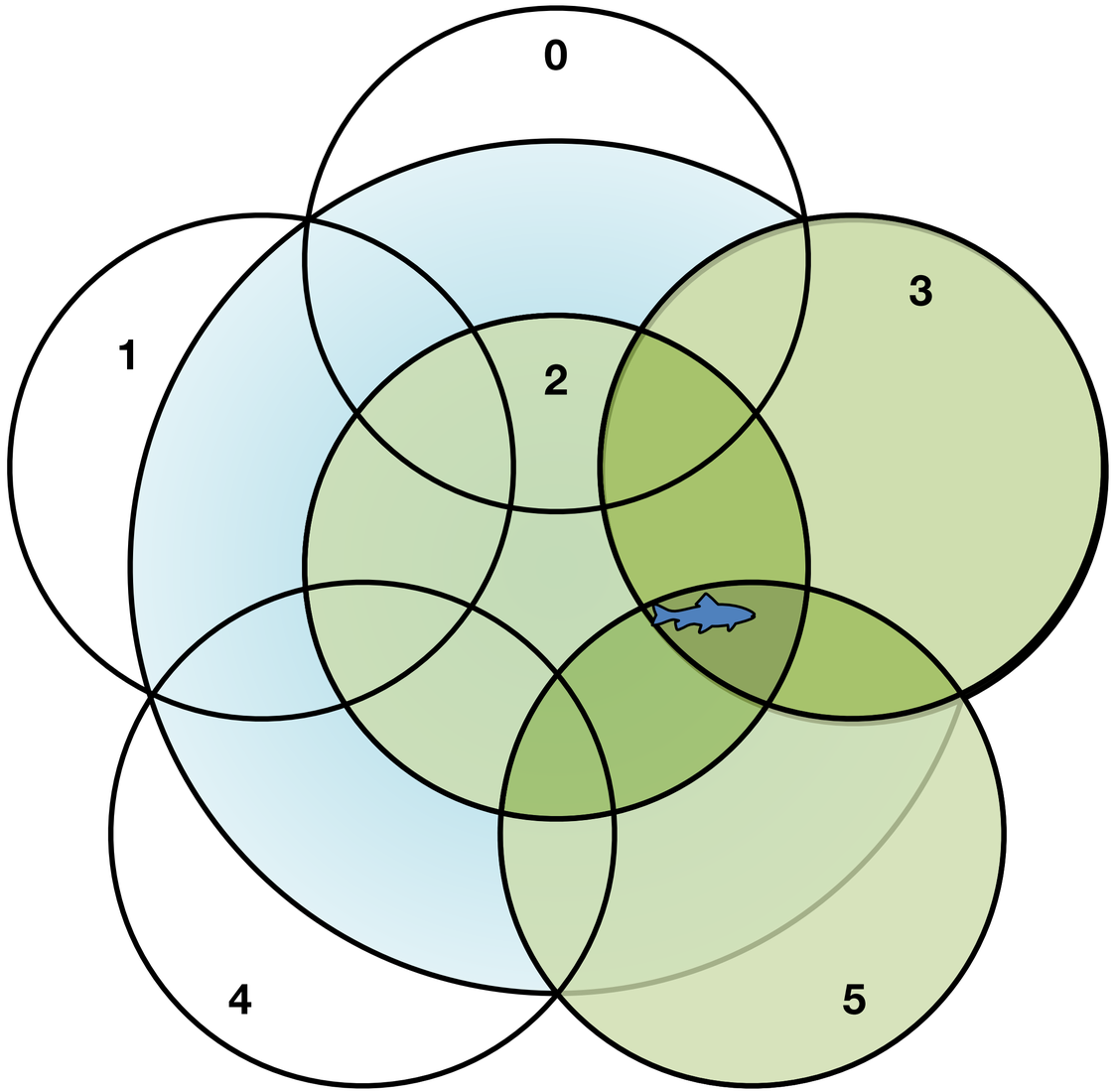
# The midterm recap

- with martha

# Broadness of generalization







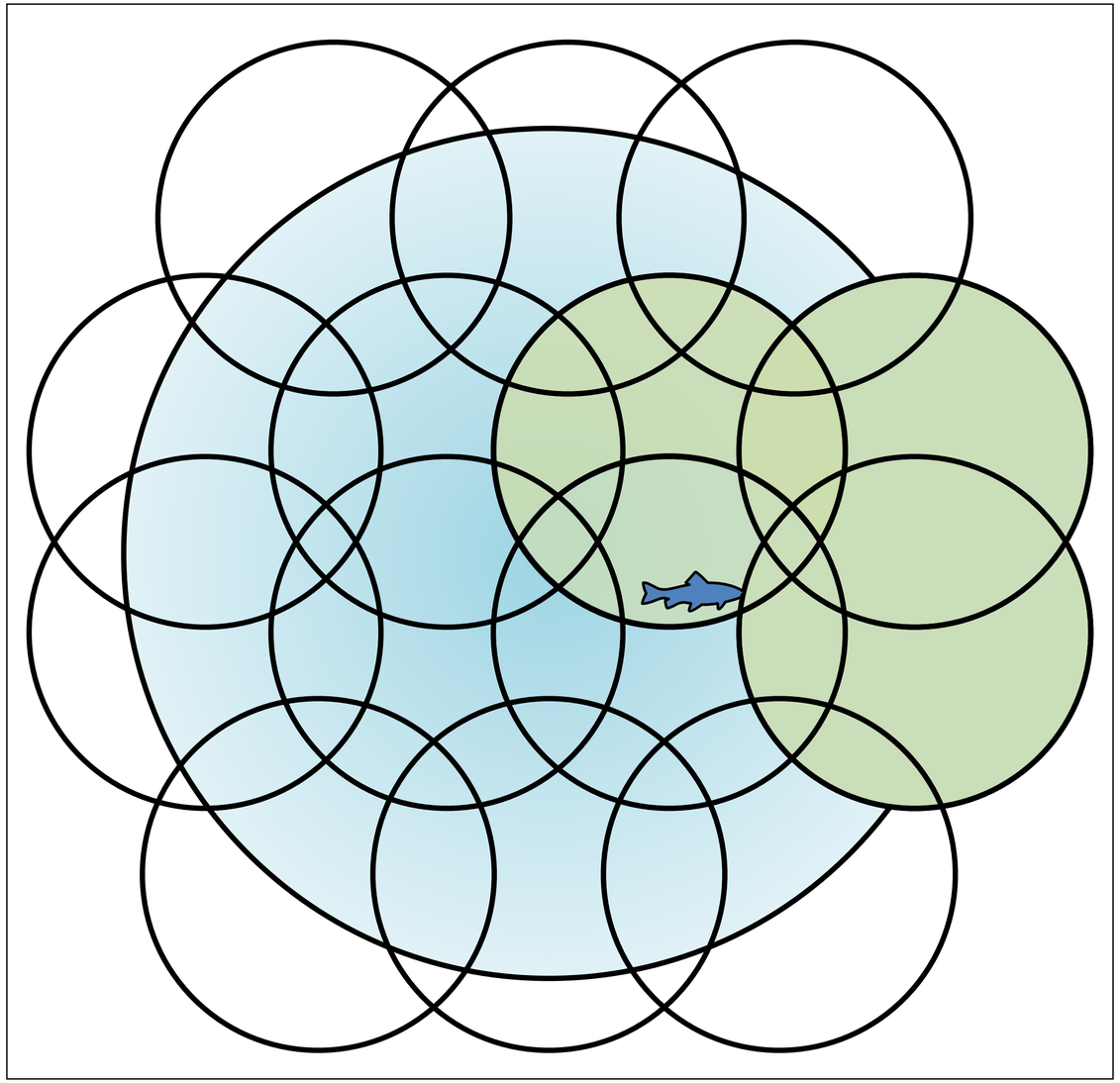

$$v_\pi(s) \approx \hat{v}(s, \mathbf{w}) = \mathbf{w}^T \mathbf{x}(s)$$

$$\mathbf{w} = \begin{bmatrix} 0.0 \\ 1.5 \\ 1.0 \\ 0.2 \\ -0.5 \\ 0.5 \end{bmatrix} \quad S_t \quad \mathbf{x}(s) = \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1 \\ 0 \\ 1 \end{bmatrix} \qquad \hat{v}(S_t, \mathbf{w}) = 1.7$$

$$\mathbf{w} = \begin{bmatrix} 0.0 \\ 1.5 \\ 1.0 \\ 0.2 \\ -0.5 \\ 0.5 \end{bmatrix} \quad S_{t+1} \quad \mathbf{x}(s) = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{bmatrix} \qquad \hat{v}(S_{t+1}, \mathbf{w}) = 0.2$$

$$\mathbf{w} \leftarrow \mathbf{w} + \alpha[R_{t+1} + \gamma \hat{v}(S_{t+1}, \mathbf{w}) - \hat{v}(S_t, \mathbf{w})]\mathbf{x}(S_t)$$

$$\mathbf{w} \leftarrow \mathbf{w} + \alpha[R_{t+1} + \gamma * 0.2 - 1.7]\mathbf{x}(S_t)$$



# How do more and smaller circles impact things?

- Different features will be active
  - thus the updates will be different!
- The update will correspond to a smaller area
  - the weights corresponding to fewer states will be updated
  - will learning be faster or slower?
- **Any you can think of?**

# Designing NNs

- When should we value deepening a neural network over widening? What is the appropriate trade-off in efficiency and coverage?
- What are the principles when choosing an activation function? For example, the logistic function and rectifier function are said to be used often, but these two functions are very dissimilar, how should we know when to choose one?
- What are the drawbacks of more depth in an NN?
- How can we determine the number of hidden layers in a neural network necessary for quickly reaching the optimal policy?
- How can we come up with a good neural network architecture for a specific problem other than trial and error? For example, the number of nodes in each layer, number of layers, etc...

# Generalization and discrimination

- Are generalization and discrimination a trade-off in coarse coding?

- In the video, we used 40 intervals with different length to approximate a step function. The video said the longer interval archives better generalization than the shorter one. Why is that?

# Generalization and discrimination

- Why isn’t the global min the true value function?
  - Martha has a picture for this!
- **Exercise for friday:** why the TD fixed point does not minimize the MSVE?