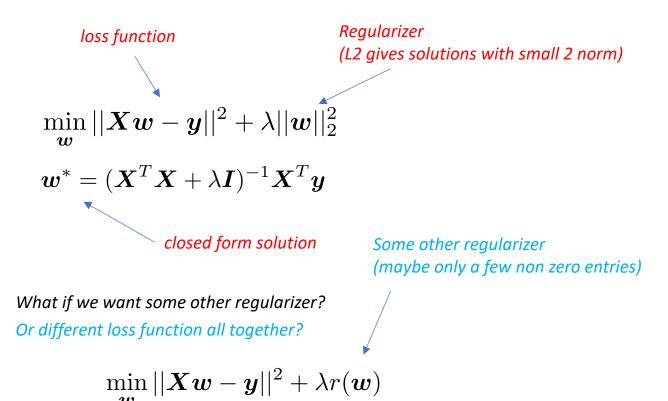
CS/ECE/ME 532 Activity 16

- Unit 3+4 Quiz Thursday in class
 - 60 minutes
 - Units 3+4 (including ridge regression)
 - no interaction with anyone besides instructors
 - must sit at your table, video must be on
- Unit 3+4 Integrative Summary assignment due Thursday evening

Today – Unit 5 (iterative methods)

Iterative Methods



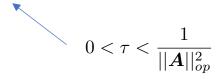
Gradient Descent

main idea: use the gradient to head downhill

goal:
$$\min_{m{w}} f(m{w})$$
 for $k=1\dots$ $m{w}^{(k+1)} = m{w}^{(k)} - au
abla f(m{w})$ step size

goal:
$$\min_{\boldsymbol{w}} ||\boldsymbol{X}\boldsymbol{w} - \boldsymbol{y}||_2^2$$
 for $k = 1...$

$$\boldsymbol{w}^{(k+1)} = \boldsymbol{w}^{(k)} - \tau (2\boldsymbol{X}^T \boldsymbol{X} \boldsymbol{w} - 2\boldsymbol{X}^T \boldsymbol{y})$$



No closed form solution.

Optimization.

Problem 1 today – see video lecture 2.8, minute 14

- do it by hand (double check with starter script)
- Find $oldsymbol{w}_{LS}$ first (using SVD) -- bottom of bowl

$$\mathbf{w}^T \mathbf{X}^T \mathbf{X} \mathbf{w} = c$$
 define an ellipse with $\mathbf{X} = \mathbf{U} \Sigma \mathbf{V}^T$ then columns of \mathbf{V} define axis

