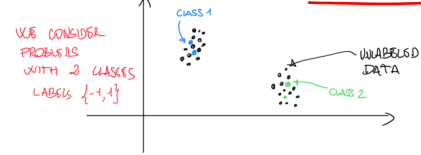


SEMI-SUPERVISED LEARNING

- WE HAVE ℓ LABELED EXAMPLES (x^i, y^i) $i=1, \dots, \ell$
- WE HAVE u UNLABELED EXAMPLES x^j $j=1, \dots, u$
- GOAL: FIND y^j !

IN REAL-WORLD PROBLEMS

- EASY TO GET DATA
- HARD TO GET LABELS \rightarrow HIGH NUMBER OF UNLABELED DATA



PARADIGM SIMILAR FEATURES \equiv SIMILAR LABELS

- DEFINE WEIGHTS $w_{ij} \rightarrow$ SIMILARITY BETWEEN
 - LABELED EXAMPLES i
 - UNLABELED EXAMPLES j
- DEFINE WEIGHTS $\bar{w}_{ij} \rightarrow$ SIMILARITY BETWEEN
 - UNLABELED EXAMPLES i, j

SQUS PROBLEM

$$\min_{y \in \mathbb{R}^u} \underbrace{\sum_{i=1}^{\ell} \sum_{j=1}^u w_{ij} (y^j - y^i)^2}_{\text{TERM 1}} + \underbrace{\frac{1}{2} \sum_{i=1}^u \sum_{j=1}^u \bar{w}_{ij} (y^i - y^j)^2}_{\text{TERM 2}}$$

$\bar{w}_{ij} = \bar{w}_{ji}$

- TERM 1: UNLABELED EXAMPLES SIMILAR LABELS TO CHOOSE LABELED ONES
- TERM 2: SIMILAR UNLABELED EXAMPLES GET SIMILAR LABELS

HOW TO CHOOSE WEIGHTS?

- USE SOME SIMILARITY MEASURES BASED ON FEATURES!

HOMEWORK 1 (DEADLINE MAY 9TH)

1. RANDOMLY GENERATE A SET OF POINTS IN 2D AND GIVE LABELS TO A SMALL SUBSET ℓ OF THOSE POINTS
2. CHOOSE A PROPER SIMILARITY MEASURE TO DEFINE w_{ij} \bar{w}_{ij}
3. CONSIDER THE PROBLEM (*)
4. SQUS PROBLEM (*) WITH
 - A. GRADIENT DESCENT
 - B. EXC4D WITH GS RULE
 - C. COORDINATE MINIMIZATION
 FOR 5. USE BOXES OF DIMENSION 1

5. CHOOSE A PUBLICLY AVAILABLE DATASET TS AND TEST THE METHODS ON THIS

6. ANALYZE ACCURACY VS COMPUTING (PLOTS)

7. DESCRIBE WHAT YOU DID ON A PDF FILE

8. UPLOAD FILES ON MOODLE (SEE TILE "HOMEWORK")

FREE TIPS

- GRADIENT WRT y^j

$$\nabla_{y^j} f(y) = 2 \sum_{i=1}^{\ell} w_{ij} (y^j - y^i) + 2 \sum_{i=1}^u \bar{w}_{ij} (y^j - y^i)$$