Announcements

- The website for the class is at Desire2Learn:
  - courses.uscden.net
- Handout: course syllabus (also posted on D2L)
- First discussion session will be tomorrow (Wed.), 12:00 - 12:55 PM, OHE 122
- My office hours this week will be:
  - Wed. 3:30 - 5:00 PM (and every week)
  - Fri. 2:30 - 4:00 PM (usual time will be 11:00 AM - 12:30 PM Fridays)

Reading

- Murphy Ch. 1 (lightly)

Today's Lecture

- Introduction to the course and to machine learning
- Administrative information
- Examples (classification and regression)

WELCOME!

EE660: MACHINE LEARNING FROM SIGNALS:

FOUNDATIONS AND METHODS

ML –

EXPECTED MACHINE TO LEARN RELATIONSHIP BETWEEN INPUTS (e.g., FEATURES OR ATTRIBUTES) AND OUTPUTS (e.g., CATEGORIES OR VALUES).

TYPICALLY, THIS RELATIONSHIP IS UNKNOWN IN ADVANCE.

→ MACHINE LEARNS FROM DATA

→ CAN GENERALIZE TO NEW DATA.

HOW DO WE KNOW WHETHER THE MACHINE HAS ACTUALLY ~~LEARN~~ LEARNED?

→ TEST IT ON PREVIOUSLY UNSEEN DATA.

→ TRY 1 NEW POINT (new input) —
MACHINE COULD GET RIGHT OUTPUT BY CHANCE.

COULD USE MORE DATA POINTS IN A TEST SET.

→ WE WILL USE PROBABILITY TO HELP US EVALUATE.

"SIGNALS" —

- OFTEN FROM A PHYSICAL QUANTITY, USING A SENSOR OR ~~TRASD~~ TRANSDUCER.
- OFTEN PROCESS THE DATA BEFORE INPUT TO THE ML SYSTEM.

"FOUNDATIONS" —

PRINCIPLES UNDERLYING ML TECHNIQUES

"METHODS" —

TECHNIQUES (COMMON ASPECTS), ALGORITHMS FOR M.L

[SYLLABUS— ADMINISTRATIVE PARTS]

EX. CLASSIFICATION PROBLEM —
IRIS (VARIETY) RECOGNITION.

FEATURES:

$$\underline{x} = \begin{bmatrix} \text{PETAL LENGTH} \\ \text{PETAL WIDTH} \\ \text{SEPAL LENGTH} \\ \text{SEPAL WIDTH} \end{bmatrix}$$

I/P of CLASSIFIER

O/P of " :

$\hat{y}_i = \hat{y}_i(\underline{x}_i) = 1 \text{ of } \{\text{setosa, versicolor, virginica}\}$

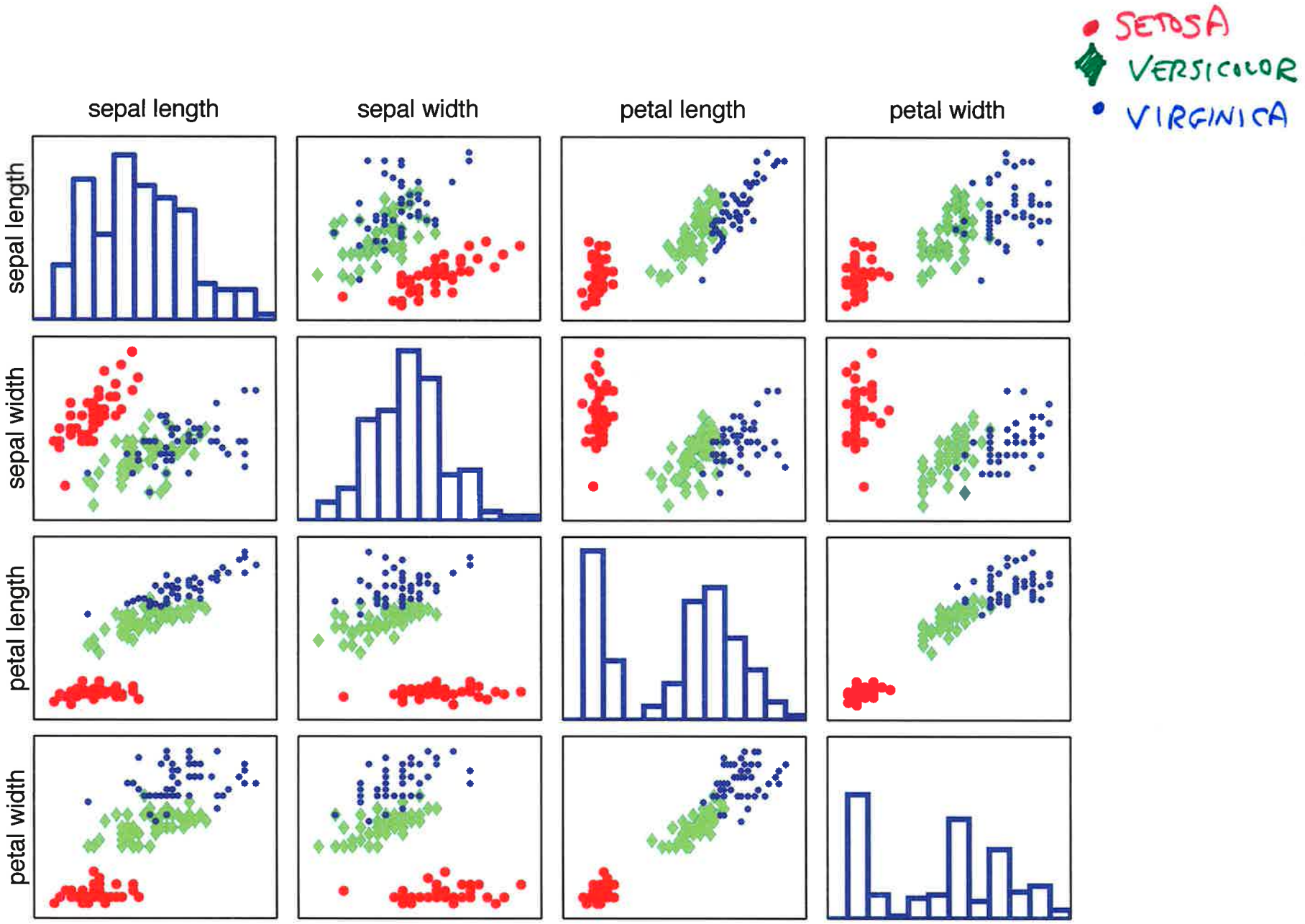
SEE EX. TRAINING DATA.

(a) setosa

(b) versicolor

Murphy Fig. 1.3.
Iris flower types

(c) virginica



Murphy Fig. 1.4. 2D feature-space plots of Iris data. Diagonal plots are histograms.

EX. OF REGRESSION

APARTMENT RENT NEAR BEACH

INPUTS :

$$\underline{x} = \begin{bmatrix} \text{LIVING AREA (sq. ft.)} \\ \text{NUMBER OF ROOMS} \\ \text{DISTANCE FROM BEACH} \\ \text{FURNISHED OR NOT} \end{bmatrix}$$

OUTPUT: $\hat{y}_i = \hat{f}(\underline{x}_i)$ = PREDICTED RENT ($)

FOR GIVEN INPUT $\underline{x}_i$.