RLP-AIDB · RLP AI Design B — Case Studies, Prototypes, Patents and Capstone

Unit 2: Building Small Models: Testing AI as Designers

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 2.1 — Artists and Machines: From AARON to Trained Collaborators

FLUENCY

1. Match each artist to the description: Vera Molnar; Lillian Schwartz; Harold Cohen; Sougwen Chung; Refik Anadol. Descriptions: (a) early computer-generated films with Bell Labs engineers; (b) the rule-based drawing program AARON; (c) computer and plotter drawings from 1968 that vary a simple form; (d) performs drawings with robotic arms trained partly on her own drawing; (e) large moving 'data paintings' made from very large datasets with machine-learning models.

2. Define *rule-based system*, *sequence data* and *state* (in an RNN).

3. What was Molnar's 'machine imaginaire', and where did authorship lie in her work, according to the lesson?

APPLICATION

4. Classify each as rule-based or machine learning and give the reason: (a) AARON; (b) Chung's robotic arms; (c) the Semester A rule 'if ratio > 2.0, label sickle' written by hand; (d) a myoelectric arm using pattern-recognition control.

5. Explain in 2-3 sentences why order matters in heart-rate data, using the lesson's example, and how an RNN uses order.

6. For Harold Cohen and AARON, state what the human decided, what the system contributed, and how the finished work shows the collaboration.

7. How do Anadol and Chung answer the consent questions about training data raised in Semester A?

REVIEW

8. Review (Semester A, Unit 2): Which 1966 program imitated a psychotherapist, who described it, and is it rule-based or learned?

Lesson 2.2 — Train, Test, Tally: A Controlled Experiment on a Classifier

FLUENCY

1. Define the four boxes of a confusion matrix: TP, FN, FP, TN.
2. Write the formula for accuracy, sensitivity, specificity and positive predictive value.
3. In the background experiment, name the independent variable, the dependent variable, and three controlled variables.

APPLICATION

4. From the recorded sheet, condition A gives TP 9, FN 1, FP 1, TN 9. Compute accuracy, sensitivity, specificity and PPV.

5. Condition B gives TP 7, FN 3, FP 4, TN 6. Compute accuracy, sensitivity, specificity and PPV (to one decimal place). Was the hypothesis (accuracy lower on the colored background) supported?

6. Using the sheet's numbers, which error type increased more from A to B, false negatives or false positives? What would that mean in a real screening tool?

7. With 10 sickle cards per condition, how much does one card change the sensitivity? What would make you more confident in the result?

8. In the lesson's worked example (TP 42, FN 8, FP 15, TN 135), show why accuracy (88.5%) alone hides something important.

REVIEW

9. Review (Semester A, Unit 1): In Semester A, one model might learn the color of a card instead of its shape. How does the background experiment test a similar risk?

Lesson 2.3 — Ninety Percent Accurate? Base Rates and Honest Accuracy Graphics

FLUENCY

1. Define *base rate*, *natural frequencies*, *icon array* and *confirmatory test*.
2. List the five questions the lesson says to ask of any accuracy claim.
3. In the lesson's worked example (1,000 people, 2% base rate, 90% sensitivity and specificity), give the four counts and the PPV.

APPLICATION

4. The same tool (90% sensitivity, 90% specificity) is used on 1,000 invented people where 10% have the condition. Find TP, FN, FP, TN and the PPV.

5. Now 1% of 1,000 invented people have the condition. Find TP, FP and the PPV to one decimal place. What pattern do you see across 1%, 2%, 10% and 50% base rates?

6. Describe the icon array for the 2% example: how many figures in each color, and what a viewer sees first.

7. An invented product page shows a big green gauge reading '90%' and the words 'Clinically proven.' Write a critique using two of the five questions, then a natural-frequency redesign for a 2% base rate.

8. Write the strongest case, in 2-3 sentences, for the view that reporting only a company's best number is just marketing, not misleading.

REVIEW

9. Review 2.2: From the lesson-2.2 worked example (TP 42, FP 15), what is the PPV? Why is it higher than the 15.5% in this lesson's example?

Lesson 2.4 — Sequences and Anomalies: Coding a Heart-Rate Flag

FLUENCY

1. Define *baseline*, *anomaly detection* and *transparent model*.

2. State rule version 1 and rule version 2 in one sentence each.

3. Compute the version-1 baseline (average of the three previous readings) for minute 5 (previous readings 72, 74, 71) and minute 7 (previous readings 73, 75, 72). Is either reading flagged at 15 bpm?

APPLICATION

4. Using the illustrative series (72, 74, 71, 73, 75, 72, 70, 96, 98, 74, 73, 72), apply version 1 with a threshold of 10 bpm to minutes 8 to 12. Which minutes are flagged?

5. Apply version 1 with a threshold of 20 bpm. Which minutes are flagged, and what does this show about raising the threshold?

6. Apply version 2 with a threshold of 20 bpm. Which minutes are flagged? Compare with version 1 at 20 bpm.

7. Name two things the rule cannot do, and the trade-off the lesson describes between this rule and a learned sequence model.

8. Write the on-screen text and legend for the heart-rate flag sketch, following the lesson's design advice.

CHALLENGE

9. The optional clinic-guide chatbot is tested with 20 questions: 14 answered correctly, 4 unanswered (it says 'I don't have a sourced answer; please talk to a clinician'), 2 answered wrongly. Give each as a percentage, and argue which number matters most for safety.

REVIEW

10. Review (Semester A, Unit 4): Under the Semester A mapping map(bpm, 40, 120, 270, 30), where is the 74 bpm reading drawn?

Unit 2 checkpoint

1. Which artist's system was rule-based rather than machine learning?
   A. Sougwen Chung's robotic arms
   B. Harold Cohen's AARON
   C. Refik Anadol's data paintings
   D. A pattern-recognition prosthesis
2. An RNN carries a running summary called its _____ from one step of a sequence to the next.
3. True or false: Transformer models have replaced RNNs in many tasks by looking at all positions of a sequence at once.
4. A test has TP = 30, FN = 10, FP = 5, TN = 55. What is its sensitivity?
   A. 75%
   B. 85%
   C. 91.7%
   D. 30%
5. For the same test (TP = 30, FN = 10, FP = 5, TN = 55), what is the specificity?
   A. 75%
   B. 85%
   C. 91.7%
   D. 55%

6. A condition kept the same across a test so it cannot explain the results is a _____ variable.

7. A tool with 90% sensitivity and 90% specificity is used where 2% of people have the condition. About what share of positive results are true?
   A. 90%
   B. 50%
   C. About 15.5%
   D. 2%

8. True or false: A tool's positive predictive value stays the same no matter how common the condition is in the group tested.

9. Which presentation of a screening result does research on risk communication suggest is easiest to understand?
   A. A large percentage on a gauge
   B. A green tick
   C. An icon array or natural frequencies such as 18 out of 116
   D. Area under a curve

10. Under rule version 1 (threshold 15 bpm), why is minute 11 (73 bpm) a false alarm?
    A. 73 is too low for anyone
    B. The earlier spike raised the baseline to about 89.3
    C. The code has a typo
    D. The threshold is 5 bpm

11. True or false: The heart-rate flag sketch should state on screen that the data is illustrative and the flag is not a diagnosis.

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