Grade 7 Computing

Unit 10 · How Machines Learn

ANSWER KEY · FOR TEACHERS

Full marks 30

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. dataset
2. training set
3. test set
4. labeling
5. nonexamples
6. accuracy
7. biased
8. one-sided data

Each carries 0.5 mark. **K · 4**

2 Label the diagram

1. One row: one example
2. All the rows together: the training data.
3. Features: what is measured
4. Label

Each carries 0.5 mark. **K · 2**

3 Multiple choice

i. **c.** whether that bus did arrive late **A · 1**

The label is the answer the model must learn to give: late or not late, recorded for each past trip. The time, passengers and rain are features: things known about each trip that might help.

ii. **c.** It remembers its training examples but does much less well on new ones; 60% is the honest measure. **U · 1**

The score on the training examples shows only that it remembers them. The score on examples it has never seen is what tells you how it will do in use.

iii. **c.** 85% **A · 1**

51 ÷ 60 × 100% = 85%.

iv. **c.** adding examples of ripe and unripe Bambaiya to the training data **U · 1**

It does badly because Bambaiya were missing from its examples. Examples of the missing group, both ripe and unripe, teach it what tells them apart. More of what it already knows changes little, and testing on fewer Bambaiya only hides the problem.

v. **b.** reporting only the total accuracy, not the accuracy for each group **U · 1**

A total can hide a group the model does badly on, as with the mango model's 75% that hid 50% for Bambaiya. Keeping the test set apart and choosing it at random are good practice.

4 Calculations

a. **ANSWER** **A · 2**

Model A: 42 ÷ 50 × 100% = **84%**. Model B: 70 ÷ 80 × 100% = **87.5%**.
Model B is more accurate, though it got more photos wrong (10 against 8): compare the percentages, not the counts.

MARKING SCHEME

✓ Model A: 42 ÷ 50 × 100% = 84%; Model B: 70 ÷ 80 × 100% = 87.5%.
✓ Model B is more accurate.

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b. ANSWER A · 4

i. 102 ÷ 120 × 100% = **85%.**

ii. Rice: 87 ÷ 90 × 100% ≈ **96.7%.** Maize: 15 ÷ 30 × 100% = **50%.**

iii. The total of 85% hides a model that is very good on rice and right only half the time on maize: it is biased against maize, probably because there were few maize examples in its training data. The team should collect more maize examples and report the accuracy for each crop.

MARKING SCHEME

✓ i. 102 ÷ 120 × 100% = 85%.

✓ ii. Rice: 87 ÷ 90 × 100% ≈ 96.7%.

✓ ii. Maize: 15 ÷ 30 × 100% = 50%.

✓ iii. The total hides that it is right only half the time on maize: it is biased against maize (too few maize examples).

5 Short answers

a. ANSWER A · 4

Features: the morning's humidity, the cloud cover at 9 a.m., the wind speed and the month.

Label: whether it rained that afternoon (yes or no).

A feature that might help: the air pressure in the morning, or whether it rained the day before. A feature that would not help: the day of the week, or the name of the person who wrote the record. (Any sensible answers, with a reason: a helpful feature changes with whether it rains.)

MARKING SCHEME

✓ Features: the morning's humidity, the cloud cover at 9 a.m., the wind speed and the month.

✓ Label: whether it rained that afternoon.

✓ A feature that might help, such as the morning's air pressure or whether it rained the day before.

✓ A feature that would not help, such as the day of the week or the name of the person who wrote the record.

b. MARKING SCHEME U · 3

✓ Things that are not what the model is looking for, shown to it with that label, so it learns what its answer is not.

✓ Two nonexamples for a momo-finder, such as a plate of idli, a bowl of rice, a white folded cloth.

✓ Look-alikes are near the edge between momo and not momo, so they teach which differences matter.

6 Long answer

ANSWER

A model is **biased** when it works worse for one group of people or things than for others because of how it was made, usually because of its data.

Example: a mango model trained only on kinds of mango that turn yellow when ripe learns that green means not ripe. A Bambaiya mango stays green when it is ripe, so the model calls ripe Bambaiya "not ripe": in the widget it was right about every other mango and half the Bambaiya. Nothing in the program was wrong; the training data was one-sided, with no Bambaiya in it. (Other good examples: voice typing trained mostly on English or on one accent; face systems trained mostly on lighter-skinned faces; photo models trained mostly on photos from rich countries, which called a bar of soap from a home in Nepal "food".)

MARKING SCHEME

✓ A model is biased when it works worse for one group than for others because of how it was made (usually its data).

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- ✓ One-sided training data: too few, or no, examples of some of the things the model will meet.
- ✓ An example of a group left out of the data, such as only mangoes that turn yellow, with no Bambaiya (or one accent, lighter-skinned faces, photos from rich countries).
- ✓ What happens: the model does badly on that group, such as calling ripe Bambaiya "not ripe" because in its examples green meant not ripe.

U · 4

7 Think

ANSWER

HA · 2

No. The data shows what happened, not what a student can do. Perhaps students from those villages had a long walk, no electricity to study by, or had to leave school to work: exactly the students a scholarship is meant to help. A model that learns "this village rarely finishes" would turn that old unfairness into a rule, and make it continue. The village should not be a feature at all; people, not the model alone, should make the final decision.

MARKING SCHEME

- ✓ No: the data shows what happened to past students (a long walk, work, no electricity), not what this student can do.
- ✓ Using the village would turn an old unfairness into a rule; leave the village out as a feature (and let people decide).

8 Activity: Does voice typing hear everyone?

(not marked)

WHAT STUDENTS SHOULD FIND

Voice typing usually does well for some speakers and worse for others: for a quiet voice, a strong local accent, a speaker whose first language isn't Nepali, or in a noisy room. Accuracy is words typed right ÷ words spoken × 100%. The differences come from the data: accents and voices that were rare among its training recordings are heard less well. One sentence is a small test, so a careful group would try several sentences before deciding.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	6	10	12	2	**30**

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