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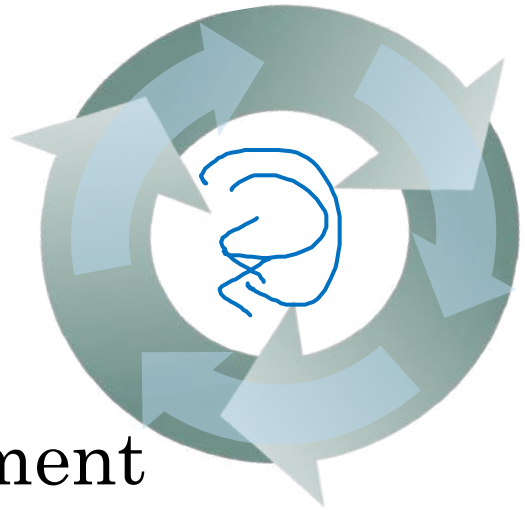
Setting up your goal

Single number evaluation metric

Using a single number evaluation metric



Of examples recognized as cat, what % actually are cats?

What % of actual cats are correctly recognized

Classifier	Precision	Recall
A	95%	90%
B	98%	85%

F1 score = "Average" of P and R.

($\frac{2}{\frac{1}{P}+\frac{1}{R}}$. "Harmonic mean")

Dev set + Single number evaluation metric

Speed up iterating

Another example

Algorithm	US	China	India	Other
A	3%	7%	5%	9%
B	5%	6%	5%	10%
C	2%	3%	4%	5%
D	5%	8%	7%	2%
E	4%	5%	2%	4%
F	7%	11%	8%	12%

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Setting up your goal

Satisficing and optimizing metrics

Another cat classification example

optimizing ↓ ↓ satisficing

Classifier	Accuracy	Running time
A	90%	80ms
B	92%	95ms
C	95%	1,500ms

Cost = accuracy − 0.5 * running Time

Maximize accuracy

subject to runningTime ≤ 100 ms.

N metrics: 1 optimizing

N−1 satisficing

Wakewords / Trigger words

Alexa, OK Google,

Hey Siri, nihaobaidu

你好百度

accuracy.

#false positive

Maximize accuracy.

s.t. ≤ 1 false positive

every 24 hours.

Andrew Ng

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Setting up your goal

Train/dev/test distributions

Cat classification dev/test sets

development set, hold out cross validation set

Regions:

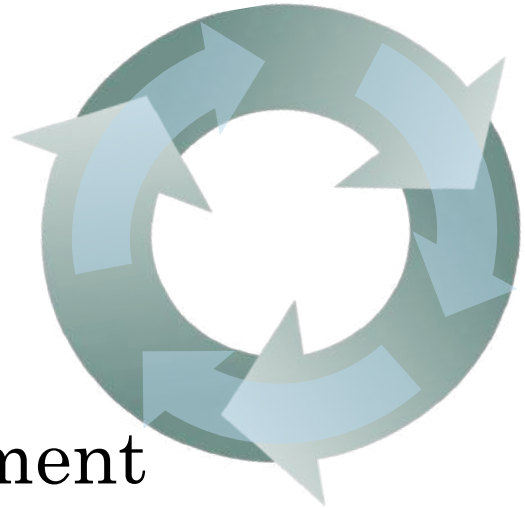
- US
- UK
- Other Europe
- South America
- India
- China
- Other Asia
- Australia

Dev

Test

Randomly shuffle into dev/test

dev set + metric



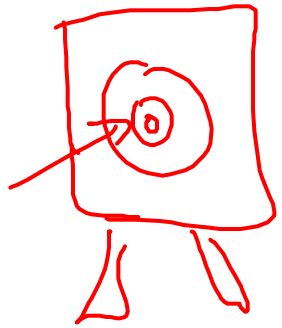
True story (details changed)

Optimizing on dev set on loan approvals for medium income zip codes

$x \rightarrow y$ (repay loan?)

Tested on low income zip codes

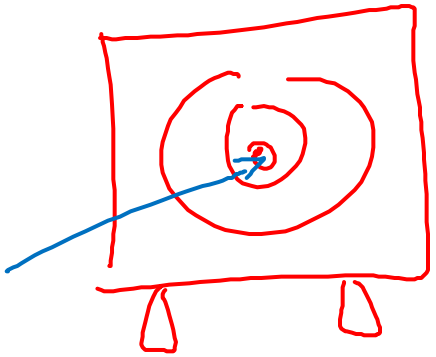
~3 month



Guideline

Same distribution

Choose a dev set and test set to reflect data you expect to get in the future and consider important to do well on.



training

dev

test

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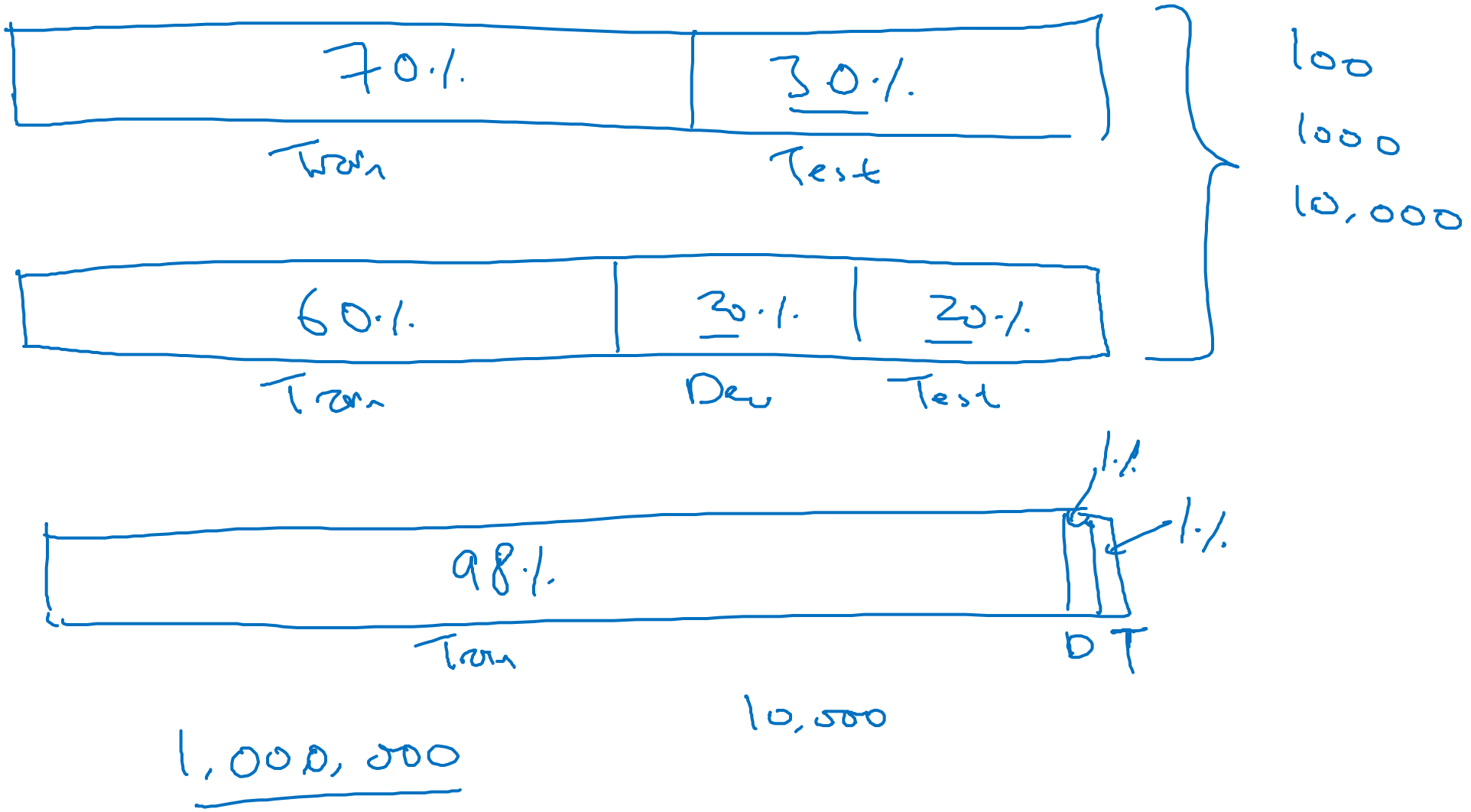
Setting up your goal

Size of dev and test sets

Old way of splitting data



Size of dev set

A B

Set your dev set to be big enough to detect differences in algorithm/models you're trying out.

A B

97% → 97.1%

0.1%

100: small

1%

1,000

10,000

100,000

0.01%

0.001%

Online advertising

Size of test set

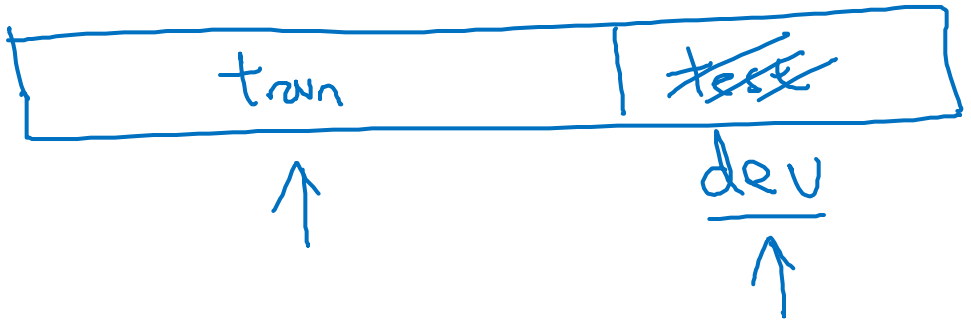
- Set your test set to be big enough to give high confidence in the overall performance of your system.

10,000

100,000

Train + Dev.

No test set.



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Setting up
your goal

When to change dev/test sets and metrics

Cat dataset examples

Metric + Dev : Prefer A

Your users : Prefer B.

→ Metric: classification error

Algorithm A: 3% error → pornographic

✓ Algorithm B: 5% error

$$\text{Error}: \frac{1}{\sum w^{(i)}} \cancel{\frac{1}{m_{dev}}} \sum_{i=1}^{m_{dev}} w^{(i)} \mathbb{1}\{y_{pred}^{(i)} \neq y^{(i)}\}$$

$y_{pred}^{(i)}$: predicted value (0/1)

$$\rightarrow w^{(i)} = \begin{cases} 1 & \text{if } x^{(i)} \text{ is non-porn} \\ 10 & \text{if } x^{(i)} \text{ is porn} \end{cases}$$

Orthogonalization for cat pictures: anti-porn

1. So far we've only discussed how to define a metric to evaluate classifiers. ← Place target

2. Worry separately about how to do well on this metric. ← Aim/shoot at target

$$J = \frac{1}{\sum w^{(i)}} \sum_{i=1}^{m} w^{(i)} \mathcal{L}\left(\hat{y}^{(i)}, y^{(i)}\right)$$

Another example

Algorithm A: 3% error

Algorithm B: 5% error

Dev/test



User images



If doing well on your metric + dev/test set does not correspond to doing well on your application, change your metric and/or dev/test set.