

Data Mining - evaluation

Date

- ❖ Suppose we want to know if a person has a specific cancer or not.
- ❖ Suppose we have a test that will return + or -
- ❖ We have prior knowledge that over the entire population only .008 (.8%) have this disease.
- ❖ The test returns a correct positive 98% of the time a person has cancer
- ❖ It returns a correct negative 97% of the time a person doesn't

- ❖ Suppose we want to know if a person has a specific cancer or not.
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- ❖ What is the probability the next slide will be about Naive Bayes?

- ❖ The test returns a correct positive 98% of the time a person has cancer
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TP
TN
FP
FN

- ❖ The test returns a correct positive 98% of the time a person has cancer
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TP= ??

TN= ??

FP= ??

FN=??

- ❖ The test returns a correct positive 98% of the time a person has cancer
- ❖ It returns a correct negative 97% of the time a person doesn't

TP= .98

TN= .97

FP= .03

FN=.02

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Sample size of 200 - 100 w/ cancer 100 w/o

TP= .98

TN= .97

FP= .03

FN=.02

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Sample size of 200 - 100 w/ cancer 100 w/o

TP= .98

TN= .97

FP= .03

FN=.02

	Test says positive	Test says negative
Real world positive		
Real world negative		

- ❖ The test returns a correct positive 98% of the time a person has cancer
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Sample size of 200 - 100 w/ cancer 100 w/o

TP= .98

TN= .97

FP= .03

FN=.02

	Test says positive	Test says negative
Real world positive	TP = 98	FN=2
Real world negative	FP=3	TN=97

- ❖ The test returns a correct positive 98% of the time a person has cancer
- ❖ It returns a correct negative 97% of the time a person doesn't

Sample size of 200 - 100 w/ cancer 100 w/o

What is the accuracy of the test?

$$TP = .98$$

$$TN = .97$$

$$FP = .03$$

$$FN = .02$$

$$\frac{TP + TN}{TP + TN + FP + FN} = 97.5\%$$

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Sample size of 200 - 100 w/ cancer 100 w/o

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$$FP = .03$$

$$FN = .02$$

$$\frac{TP + TN}{TP + TN + FP + FN} = 97.5\%$$

Are FP and FN equal in importance?



8 people out of 1000 have
Pyruvate kinase deficiency

Test 1

TP=.999

TN=.990

FP=.01

FN=.001

accuracy=99.5

Test 2

TP=.990

TN=.990

FP=.001

FN=.01

accuracy=99.5

Test 1 and 2 mutually exclusive

Without treatment, a person will die in 24 hours.
Treatment is taking Azizafened, a drug with minor side effects. Which test to administer?

Test 1
TP=.999
TN=.990
FP=.01
FN=.001
accuracy=99.5

Test 2
TP=.990
TN=.990
FP=.001
FN=.01
accuracy=99.5

Test 1 and 2 mutually exclusive

Test 1
 TP=.999
 TN=.990
 FP=.01
 FN=.001
 accuracy=99.5

Test 2
 TP=.990
 TN=.990
 FP=.001
 FN=.01
 accuracy=99.5

100,000 people

		Test says positive	Test says negative
800	Real world positive	TP =	FN=
99,200	Real world negative	FP=	TN=

Test 1
 TP=.999
 TN=.990
 FP=.01
 FN=.001
 accuracy=99.5

Test 2
 TP=.990
 TN=.990
 FP=.001
 FN=.01
 accuracy=99.5

100,000 people

		Test says positive	Test says negative
800	Real world positive	TP1 =799 TP2=792	FN1=1 FN2=8
99,200	Real world negative	FP1=992 FP2=92	TN1=98,208 TN2=99,108

Test 1
 TP=.999
 TN=.990
 FP=.01
 FN=.001
 accuracy=99.5

Test 2
 TP=.990
 TN=.990
 FP=.001
 FN=.01
 accuracy=99.5

Which cell is the one
 where people die?

100,000 people

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99,200	Real world negative	FP1=992 FP2=92	TN1=98,208 TN2=99,108

Test 1
 TP=.999
 TN=.990
 FP=.01
 FN=.001
 accuracy=99.5

Test 2
 TP=.990
 TN=.990
 FP=.001
 FN=.01
 accuracy=99.5

Change story
 8 out of 1000 are
 compatible w/ any one
 person wrt kidney
 transplants

100,000 people

		Test says positive	Test says negative
800	Real world positive	TP1 =799 TP2=792	FN1=1 FN2=8
99,200	Real world negative	FP1=992 FP2=92	TN1=98,208 TN2=99,108

Test 1
 TP=.999
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Test 2
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If test negative, person removed from candidate pool. If test is positive, person subject to further painful testing which involves long needles.

100,000 people

		Test says positive	Test says negative
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Summary

just an accuracy measure may not be sufficient.

Need to look at FP, FN, and see how that matches problem.



Which to minimize: FP or FN?

- ❖ I own a startup and am looking to hire 5 new developers.
- ❖ There are 300k layoffs this year so the pool of candidates is fantastic.
- ❖ What I don't want is to hire a loser
- ❖ I have various hiring methods I can use, each w/ a known FP and FN. Which should I select?

Which to minimize

- ❖ I own a roofing company
- ❖ I develop a data mining tool to select people who are likely to buy our service.
- ❖ With the people identified by the tool, my sales force will call them to do direct marketing.

Which to minimize

- ❖ a smoke detector
- ❖ pandora recommender
- ❖ terrorist detector

Related Concepts- Recall/Precision

- ❖ **Precision**: Percentage of retrieved documents that are relevant: $TP / (TP + ?)$
- ❖ **Recall**: Percentage of relevant documents that are returned: $TP / (TP + ?)$

Related Concepts- Recall/Precision

- ❖ **Precision**: Percentage of retrieved documents that are relevant: $TP / (TP + FP)$
- ❖ **Recall**: Percentage of relevant documents that are returned: $TP / (TP + FN)$

What about browsing and search?

What about browsing and search?

- ❖ Search results don't have to be very good
- ❖ Recall? Not important. as long as you get at least some good hits.
- ❖ Precision? Not important. As long as at least some of the hits on the first page you return are good.

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Page 2 of about 2,680,000 results (0.59 seconds)

Docker - ArchWiki - Arch Linux

<https://wiki.archlinux.org/index.php/Docker> ▾ Arch Linux ▾

Jump to [Build Image](#) - Instead, check **docker base/archlinux** registry and click the **mkimage-arch.sh** link to download **mkimage-arch.sh** and ...

Official 13.1 Docker Containers Released - openSUSE News

[news.opensuse.org › 2014 › 08 › 07](https://news.opensuse.org/2014/08/07/) ▾ openSUSE ▾

Aug 7, 2014 - Creating a **docker** application based on the official **containers** is easy too. ... It creates one of the world's best **Linux** distributions, working ...

Oracle Linux images for Docker released (Oracle's Linux Blog)

https://blogs.oracle.com/linux/.../oracle_linux_images... ▾ Oracle Corporation ▾

Nov 13, 2014 - The **Docker** Engine and Official Oracle **Linux** images are fully supported as part of Oracle **Linux Basic** and Premier support subscriptions.

Smaller Java images with Alpine Linux - Atlassian Developers

<https://developer.atlassian.com/.../minimal-java-docker-containe...> ▾ Atlassian ▾

Aug 10, 2015 - **docker** build -t yourname/minimal-java **docker** run -t durdn/minimal-java ... Install **curl** , **tar** , and **ca-certificates** on the **base** **alpine** image.

Building Docker Images — Project Atomic

www.projectatomic.io/docs/docker-building-images/ ▾

Resource management and process isolation come from **Linux Containers** (LXC). ... The **Dockerfile** describes a **base** image for the build using the **FROM** ...

How To Install and Use Docker: Getting Started | DigitalOcean

<https://www.digitalocean.com/.../how-to-install-and-use-docker-getting-st...> ▾

Dec 11, 2013 - **docker** containers: directories containing everything-your-application; **docker** images: snapshots of containers or **base** OS (e.g. **Ubuntu**) images ...

Size of Docker images: Which linux is smaller? | Java Bien!

blog.javabien.net/2014/06/.../size-of-docker-images-which-linux-is-small... ▼

Jun 18, 2014 - That means that if you use multiple **images based** on the same **base** ... and an **ubuntu:14.04 containers** to tar files using **docker export . docker** ...

Docker Quick Start | SUSE Linux Enterprise Server 12

<https://www.suse.com/.../sles-12/.../dockerquick/dockerquick.html> ▼ SUSE ▼

Oct 23, 2015 - 1 Terminology; 2 Overview; 3 Setting Up a **Docker Host**; 4 **Basic Docker Operations**; 5 Building **Docker Images**; 6 SUSE **Linux Enterprise** ...

AWS Developer Forums: Amazon Linux as docker container ...

<https://forums.aws.amazon.com/message.jspa?messageID=658902> ▼

May 4, 2014 - 12 posts

Pretty lame that AWS **linux** is touted as having **docker** support etc, etc, but yet there is no official AWS **linux base image**? Whats up with this?

Creating an Oracle Enterprise Linux 6 base image for Docker

blog.grid-it.nl/.../creating-an-oracle-enterprise-linux-6-base-image-for-d... ▼

May 10, 2014 - In this post we will create an Oracle Enterprise **Linux 6 base image**, which we can use to create other **images**, for example to run Oracle XE in.

a student is doing a paper on *the intestinal absorption (bioavailability) of calcium*. what is the precision and recall of these search results?

- ❖ Calcium does not inhibit iron absorption or alter iron status in infant piglets adapted to a high calcium diet.
- ❖ Calcium absorption from small soft-boned fish.
- ❖ Bioavailability and pharmacokinetic characteristics of two monofluorophosphate preparations with calcium supplement.
- ❖ Effects of milk and milk components on calcium, magnesium, and trace element absorption during infancy.
- ❖ Bioavailability of calcium and magnesium.
- ❖ The inhibitory effect of dietary calcium on iron bioavailability: a cause for concern?
- ❖ Iron absorption from the whole diet: comparison of the effect of two different distributions of daily calcium intake.
- ❖ Strontium as a marker for intestinal calcium absorption: the stimulatory effect of calcitriol.
- ❖ Calcium bioavailability and parathyroid hormone acute changes after oral intake of dairy and nondairy products in healthy volunteers.
- ❖ Intestinal absorption of calcium from foodstuffs as compared to a pharmaceutical preparation.
- ❖ The bioavailability of dietary calcium.
- ❖ Searching for the determinants of intestinal calcium absorption

Precision and Recall - an inverse relationship

How can I maximize recall?

How can I maximize precision?

Other problems

Items exist that are marginally relevant.
There are degrees of relevance.

amazon

soy extract

Date

back to FP FN

- ❖ calculate the FP & FN for a few classification methods on the Pima data and / or the cancer data.
- ❖ Recall that the diabetes data is if the person will get diabetes in one year. The cancer data set is whether the tumor is malignant or benign.
- ❖ For these 2 data sets which (if any) measure is more important?