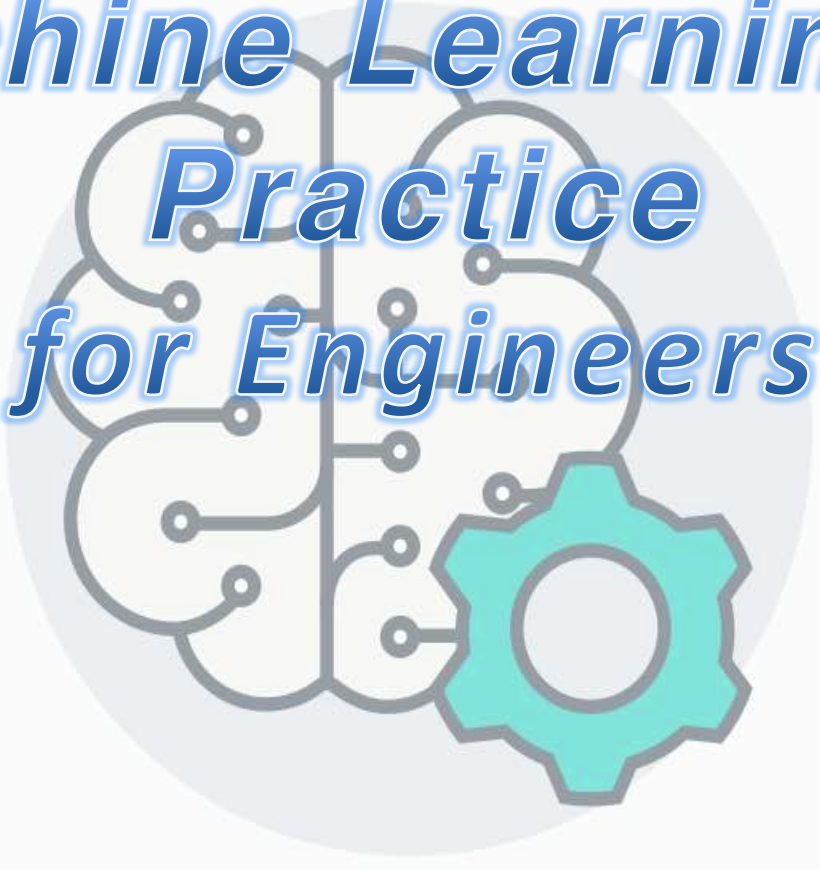
Machine Learning in Practice for Engineers



Chao Cai
@AICon
2018.1

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王天一

博士 副教授

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ArchSummit

全球架构师峰会

2018 · 深圳站

从2012年开始算起，InfoQ已经举办了9场ArchSummit全球架构师峰会，有来自Microsoft、Google、Facebook、Twitter、LinkedIn、阿里巴巴、腾讯、百度等技术专家分享过他们的实践经验，至今累计已经为中国技术人奉上了近千场精彩演讲。

限时**7折报名中**，名额有限，速速报名吧！

2012.08.10-12 深圳站

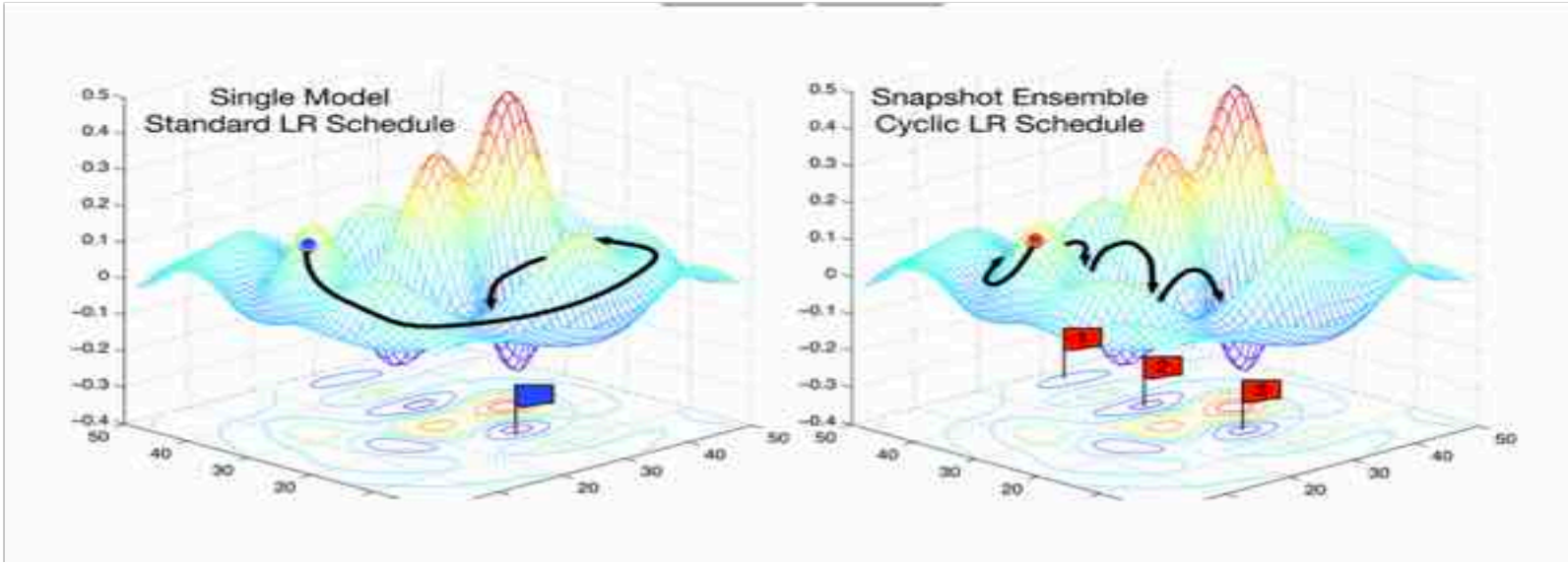
2018.07.06-09 深圳站

会议：07.06-07.07

培训：07.08-07.09

$$
\begin{aligned}
m_t &= \beta_1 m_{t-1} + (1-\beta_1) g_t \\
v_t &= \beta_2 v_{t-1} + (1-\beta_2) g_t^2 \\
\hat{m}_t &= \frac{m_t}{1-\beta_1^t} \\
\hat{v}_t &= \frac{v_t}{1-\beta_2^t} \\
\theta_{t+1} &= \theta_t - \frac{\eta}{\sqrt{\hat{v}_t} + e} \hat{m}_t - \eta w_t \theta_t
\end{aligned}
$$

$$
\begin{aligned}
m_t &= \beta_1 m_{t-1} + (1-\beta_1) g_t \\
v_t &= \beta_2 v_{t-1} + (1-\beta_2) g_t^2 \\
\hat{v}_t &= \max(\hat{v}_{t-1}, v_t) \\
\theta_{t+1} &= \theta_t - \frac{\eta}{\sqrt{\hat{v}_t} + \epsilon} m_t
\end{aligned}
$$



Common Traps

Accuracy ≠ most important metric

$$\frac{2{,}000}{1{,}000{,}000}$$

No Information Rate = 99.8%

Accuracy = (TP + TN) / (P + N)

Recall/Sensitivity/TPR = TP/ P

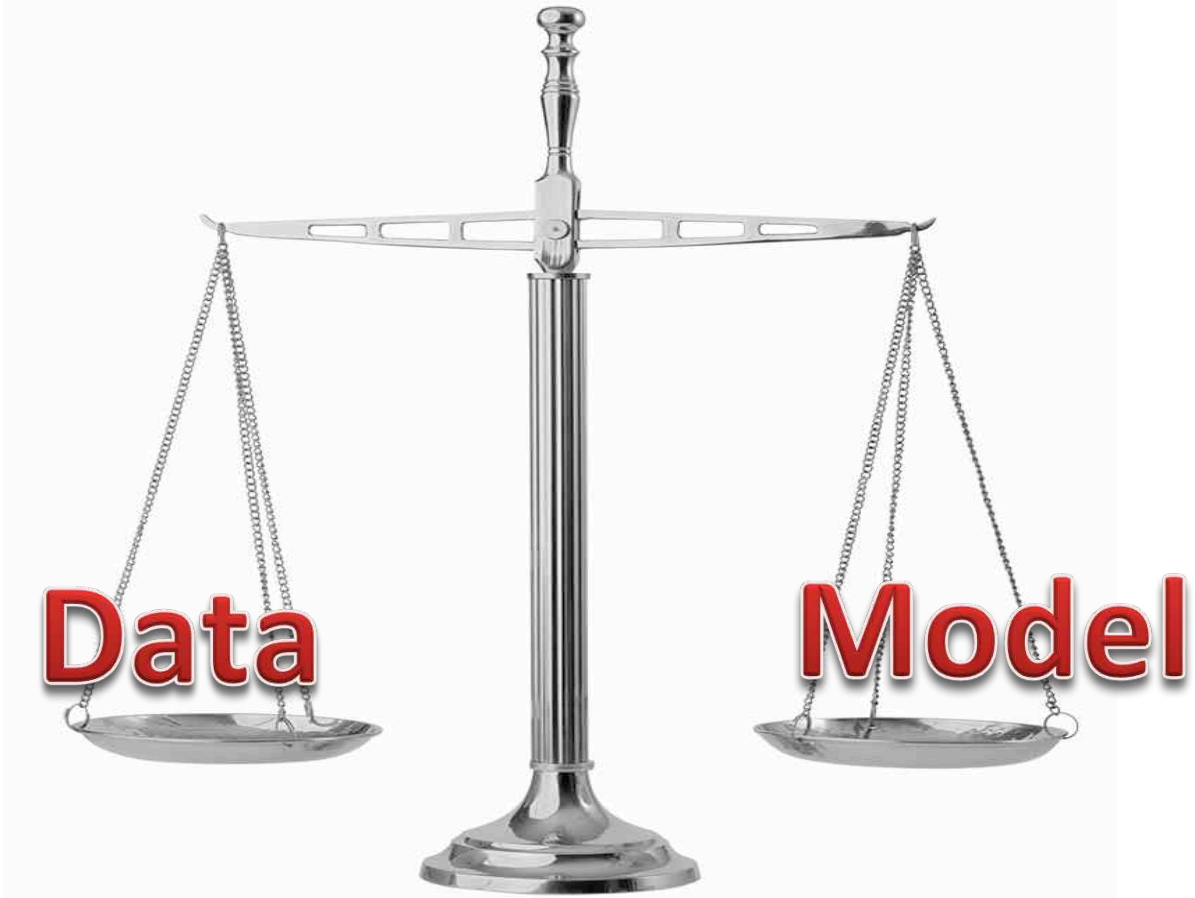
Specificity = TN / N

FRP = FP/N = 1 - Specificity

Precision = TP / (TP + FP)

Informedness = Sensitivity + Specificity - 1

ROC Curve (x= FPR, y=TPR)


Data
Model

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Amazon.cn

收件箱 - iCloud　2017年1月17日 下午11:36

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收件人：chaocai2001@icloud.com,
回复－收件人：customer_service@cs.amazon.cn

感谢您访问 Amazon！ 按照您的要求，我们已经更改了与您的帐户关联的电子邮件地址。

与您的帐户关联的电子邮件地址已被更改。原地址为 chaocai2001@yahoo.com.cn。新地址为 chaocai2001@icloud.com。

请访问您在 Amazon 上的帐户查看您的订单，更改尚未进入发货流程的订单，更新订阅及其它许多内容。

如果您因任何原因需要联系我们，请注意，我们只能将订单信息提供给与您帐户关联的姓名和电子邮件地址。

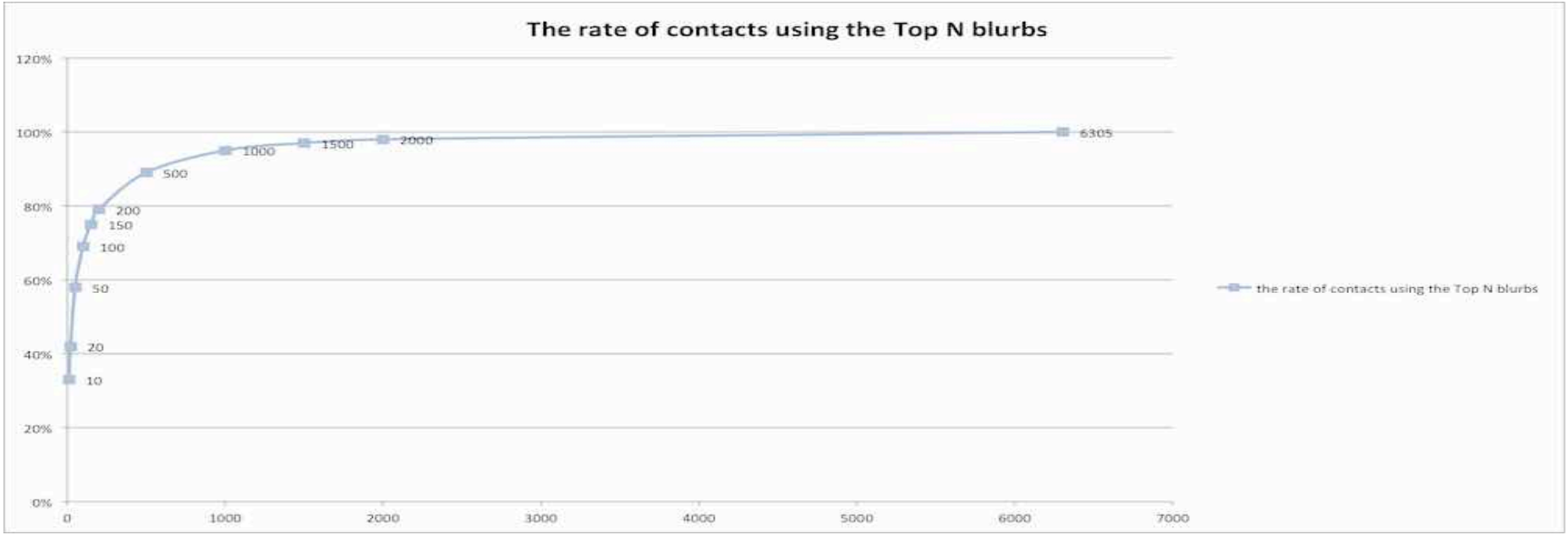
再次感谢您的惠顾。

100,000

NO

YES

Recommend by TopN



More is Better?

```
> head(Advertising)
     TV Radio Newspaper Sales
1 230.1  37.8      69.2  22.1
2  44.5  39.3      45.1  10.4
3  17.2  45.9      69.3   9.3
4 151.5  41.3      58.5  18.5
5 180.8  10.8      58.4  12.9
6   8.7  48.9      75.0   7.2
```

...

model<-train(**Sales ~.**, data=Advertising, method="glm",trControl=ctrl)

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.938889   0.311908   9.422   <2e-16 ***
TV           0.045765   0.001395  32.809   <2e-16 ***
Radio        0.188530   0.008611  21.893   <2e-16 ***
Newspaper   -0.001037   0.005871  -0.177     0.86
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

RMSE	Rsquared
1.723615	0.8914224

model<-train(**Sales ~TV+Radio** , data=Advertising, method="glm",trControl=ctrl)

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.92110    0.29449   9.919   <2e-16 ***
TV           0.04575    0.00139  32.909   <2e-16 ***
Radio        0.18799    0.00804  23.382   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

RMSE Rsquared
1.676055 0.8975927

Only Supervised?

Clustering

Most Helpful Customer Reviews

20 of 20 people found the following review helpful

★★★★☆ **Love it!**

By Patricia E. Svatos on May 23, 2014

Verified Purchase

Not a camera for professionals but has everything you'd desire for day-to-day photos. Easy to use and I highly recommend it. Also bought one for my 7-year old twins to send Grandma photos. Small enough to carry it in my purse for those unexpected photo opportunities. They also enjoy it.

Comment | Was this review helpful to you? Yes No

18 of 18 people found the following review helpful

★★★★★ **Nice little Camera for a Novice.**

By Michael C. Danford on June 7, 2014

Verified Purchase

Ordered this a couple days ago and it arrived at the specified time. It takes great photos, it's easy to use, and loading images onto my computer was breeze. Window 7 loaded all the drivers etc. and it worked fine. I bought a small tripod a few years ago. It mounts right on it, and takes crystal clear photos. Great little camera for a limited amount of money.

Comment | Was this review helpful to you? Yes No

6 of 6 people found the following review helpful

★★★★★ **It was perfect. He carried it in his pocket**

By GK on July 8, 2014

Verified Purchase

The camera was for our son for a trip out west. It was perfect. He carried it in his pocket. He took amazing pictures from a moving car! He could zoom and focus. Now that he is home we can see the pictures. Some of them look like a professional photographer. The camera is that good! He loved the camera. The battery is long lasting and it was easy to carry. We loved the camera because of the great photos!

Comment | Was this review helpful to you? Yes No

13 of 17 people found the following review helpful

Customer Images

Add an image

Most Recent Customer Reviews

★★☆☆☆ **Great camera, but it is already broken**

Great camera, but it is already broken. We have only had it for a month. We have been very pleased with it until it broke. It won't zoom out anymore and it wont turn on.

Published 10 hours ago by Jamie Loucks

★★★★★ **Five Stars**

Great

Published 2 days ago by Deserie

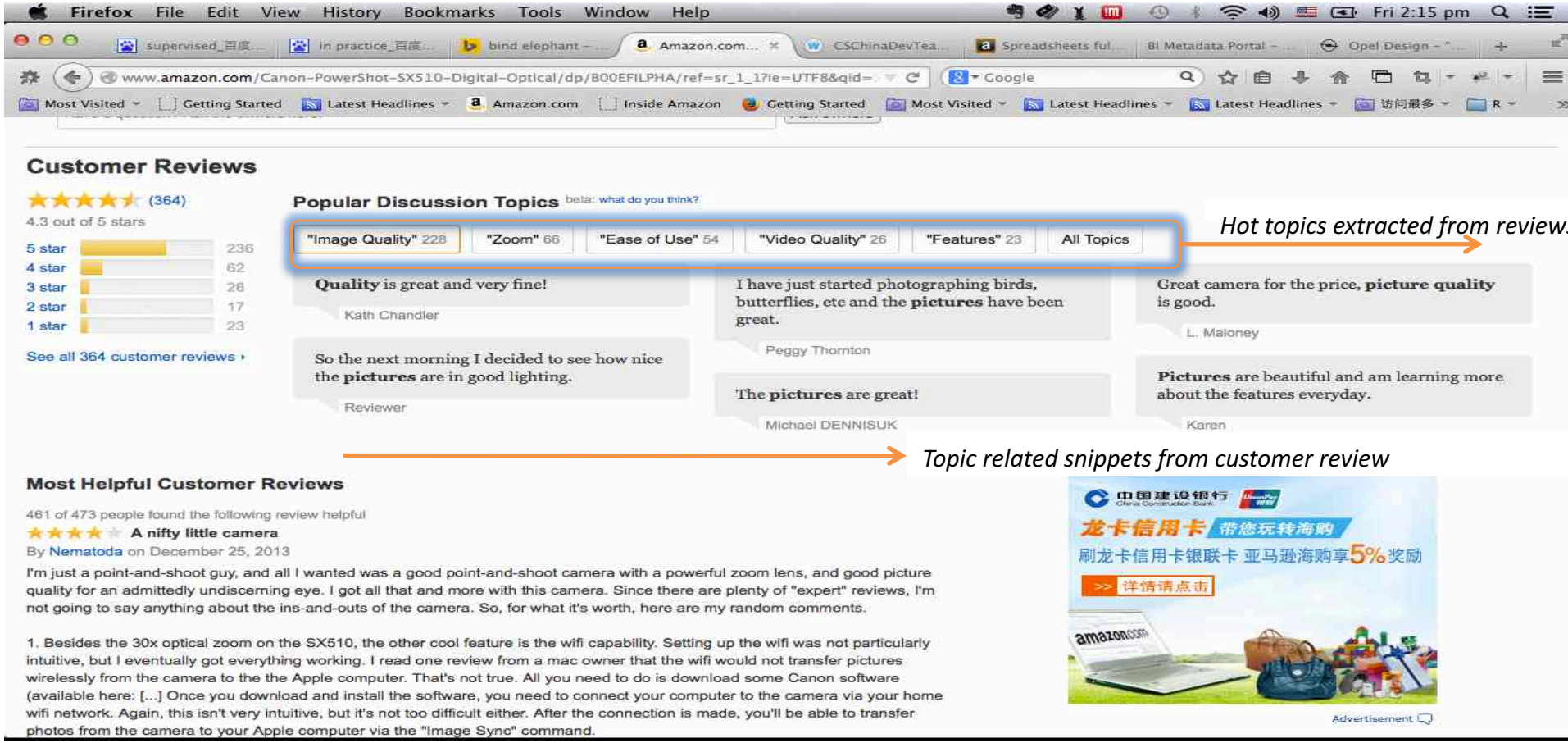
★★☆☆☆ **sort of**

I have had 2 point and shoot cameras so far and this one is the worst of them all. The other cameras were Samsungs and they were easier to operate than this one. Read more

Published 3 days ago by twf2nd

★★★★★ **Five Stars**

I love this camera! It is easy to use and takes great photos! Would highly


Firefox File Edit View History Bookmarks Tools Window Help
Fri 2:15 pm
www.amazon.com/Canon-PowerShot-SX510-Digital-Optical/dp/B00EFILPHA/ref=sr_1_1?ie=UTF8&qid=
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Customer Reviews
(364)
4.3 out of 5 stars
5 star 236
4 star 62
3 star 26
2 star 17
1 star 23
See all 364 customer reviews
Popular Discussion Topics beta: what do you think?
"Image Quality" 228
"Zoom" 66
"Ease of Use" 54
"Video Quality" 26
"Features" 23
All Topics
Hot topics extracted from review
Quality is great and very fine!
Kath Chandler
So the next morning I decided to see how nice the pictures are in good lighting.
Reviewer
I have just started photographing birds, butterflies, etc and the pictures have been great.
Peggy Thornton
The pictures are great!
Michael DENNISUK
Great camera for the price, picture quality is good.
L. Maloney
Pictures are beautiful and am learning more about the features everyday.
Karen
Topic related snippets from customer review
Most Helpful Customer Reviews
461 of 473 people found the following review helpful
A nifty little camera
By Nematoda on December 25, 2013
I'm just a point-and-shoot guy, and all I wanted was a good point-and-shoot camera with a powerful zoom lens, and good picture quality for an admittedly undiscerning eye. I got all that and more with this camera. Since there are plenty of "expert" reviews, I'm not going to say anything about the ins-and-outs of the camera. So, for what it's worth, here are my random comments.
1. Besides the 30x optical zoom on the SX510, the other cool feature is the wifi capability. Setting up the wifi was not particularly intuitive, but I eventually got everything working. I read one review from a mac owner that the wifi would not transfer pictures wirelessly from the camera to the the Apple computer. That's not true. All you need to do is download some Canon software (available here: [...] Once you download and install the software, you need to connect your computer to the camera via your home wifi network. Again, this isn't very intuitive, but it's not too difficult either. After the connection is made, you'll be able to transfer photos from the camera to your Apple computer via the "Image Sync" command.
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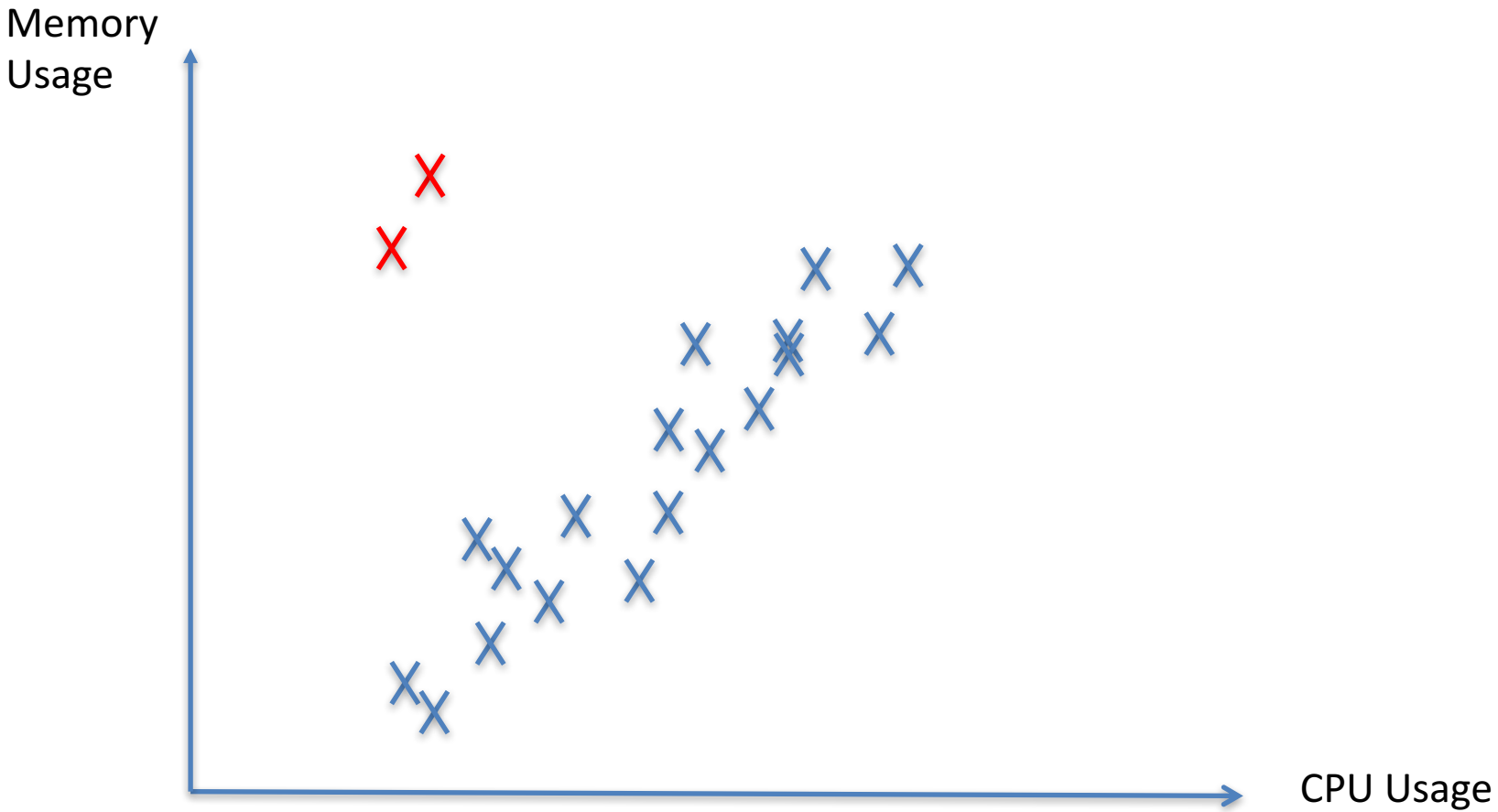
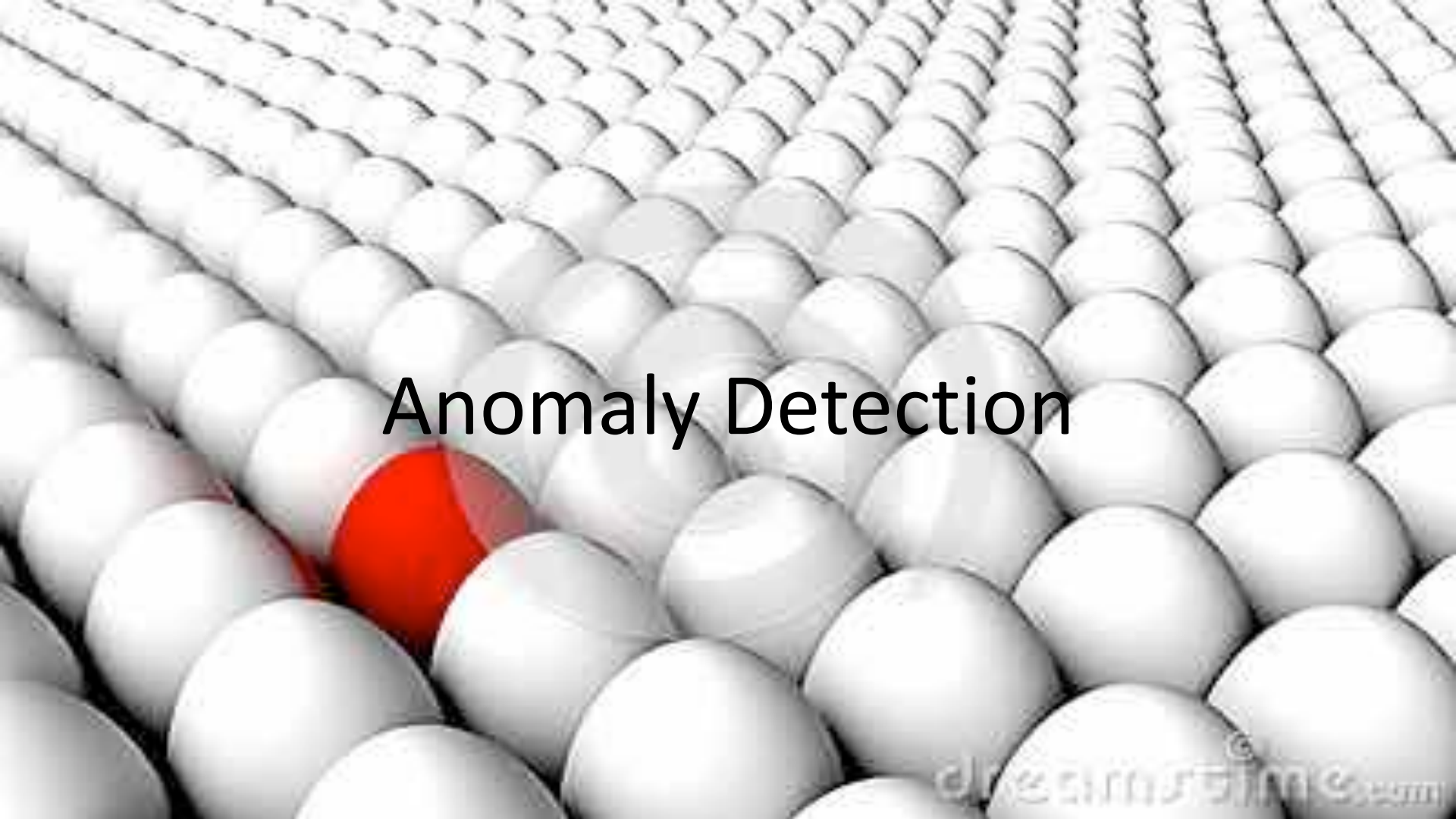
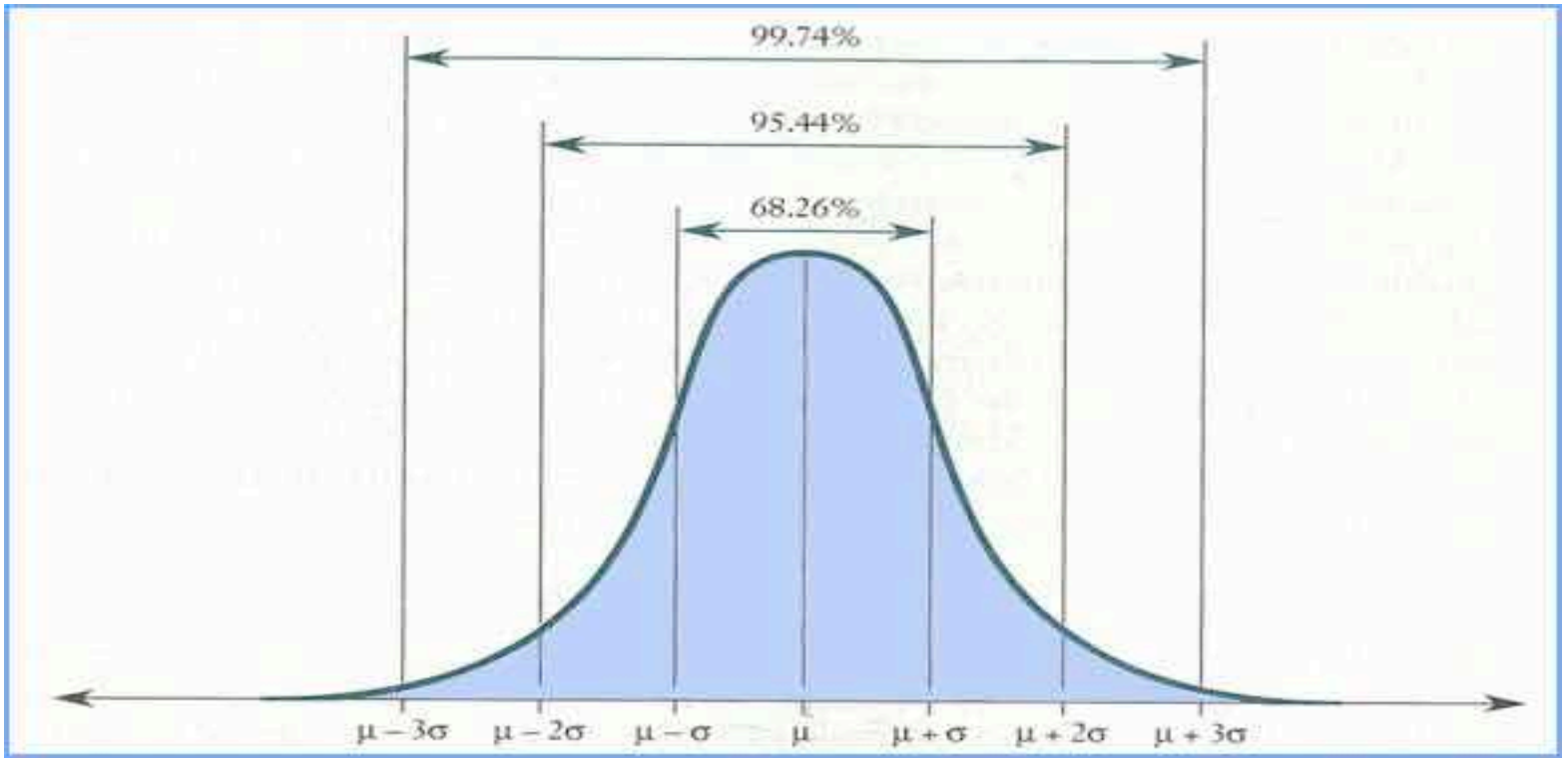
Challenges and Solutions

Imbalanced Data


Memory
Usage
CPU Usage


Anomaly Detection



$$f(x, \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Feature Vector X $\{X_1, X_2, X_3 \ldots X_n\}$

Given new example x, compute $p(x)$:

$$p(x) = \prod_{j=1}^{n} p(x_j; \mu_j, \sigma_j^2) = \prod_{j=1}^{n} \frac{1}{\sqrt{2\pi}\sigma_j} \exp\left(-\frac{(x_j - \mu_j)^2}{2\sigma_j^2}\right)$$

Anomaly if $p(x) < \varepsilon$

Multivariate Gaussian (Normal) distribution

Parameters μ, Σ

$$p(x; \mu, \Sigma) = \frac{1}{(2\pi)^{\frac{n}{2}} |\Sigma|^{\frac{1}{2}}} \exp\left(-\frac{1}{2}(x - \mu)^T \Sigma^{-1} (x - \mu)\right)$$

Anomaly detection vs. Supervised ML

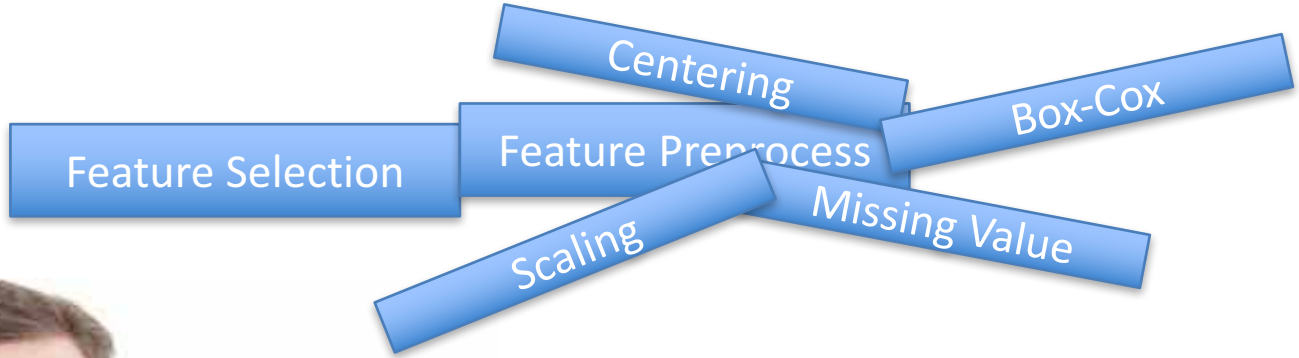
Anomaly detection

- Very small number of the anomaly (positive) samples
- Large number of the normal (negative) samples

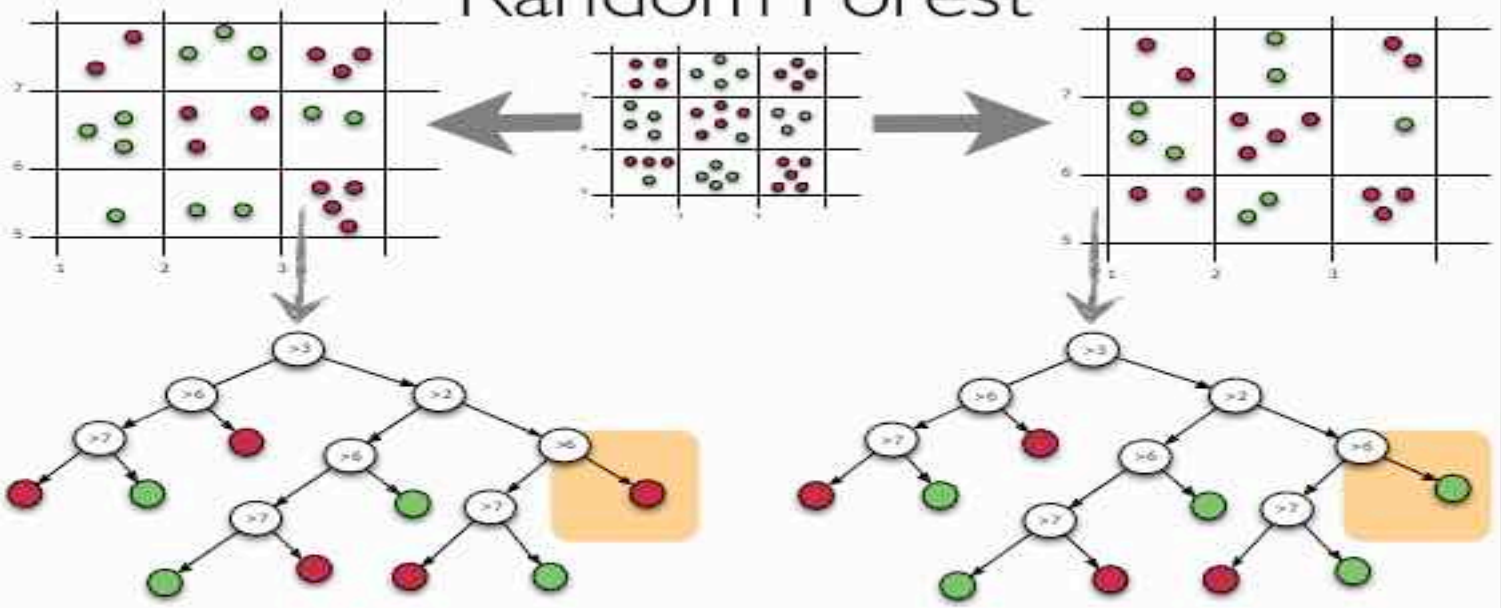
Supervised ML

- Large number of the positive and negative samples.

Feature preprocessing is hard



Random Forest



- Each tree sees part of the training sets and captures part of the information it contains

Amazon Content Compliance

amazon

Content Compliance Service

COMPLIANCE

No enough Labeled Data

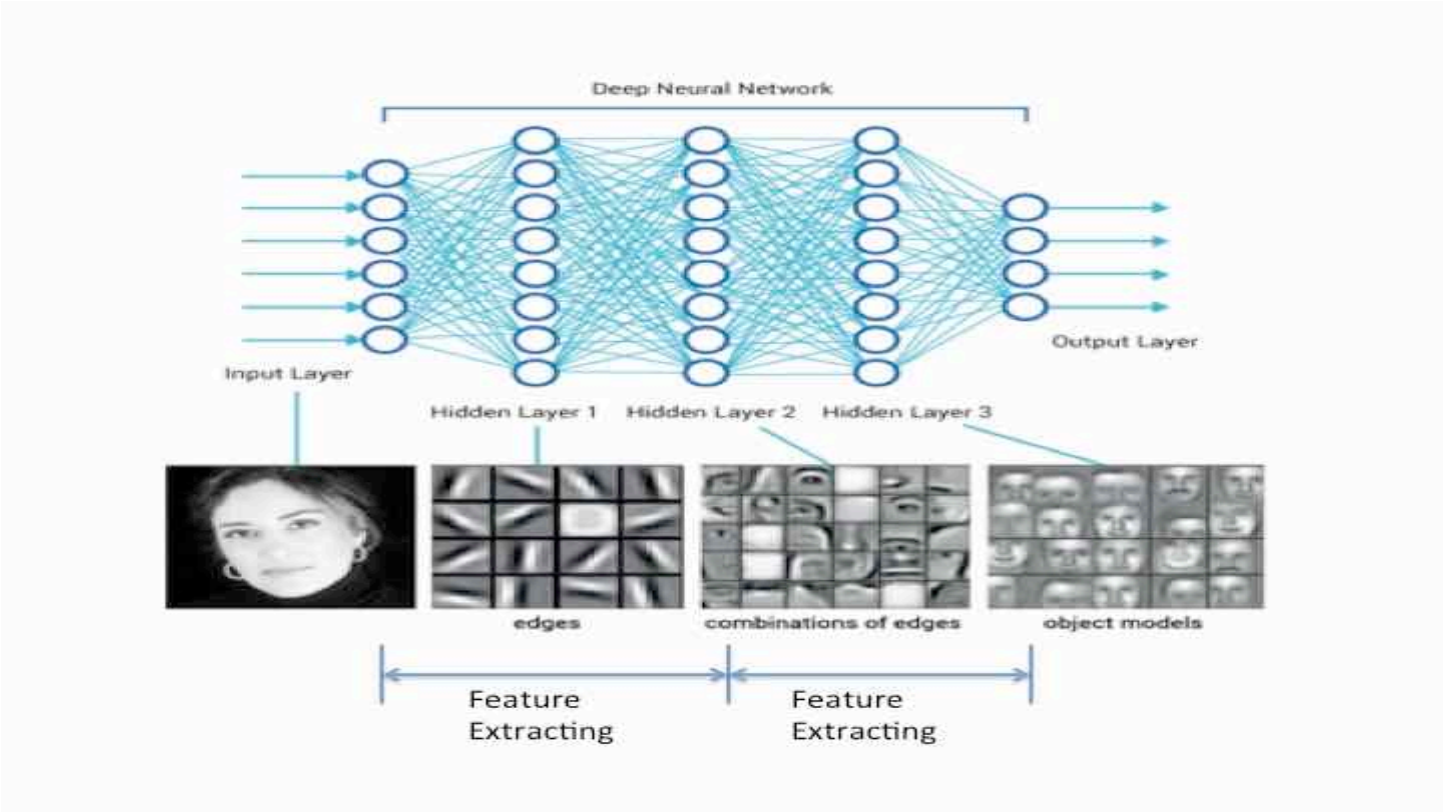
Image Augmentation

Image Compliance D

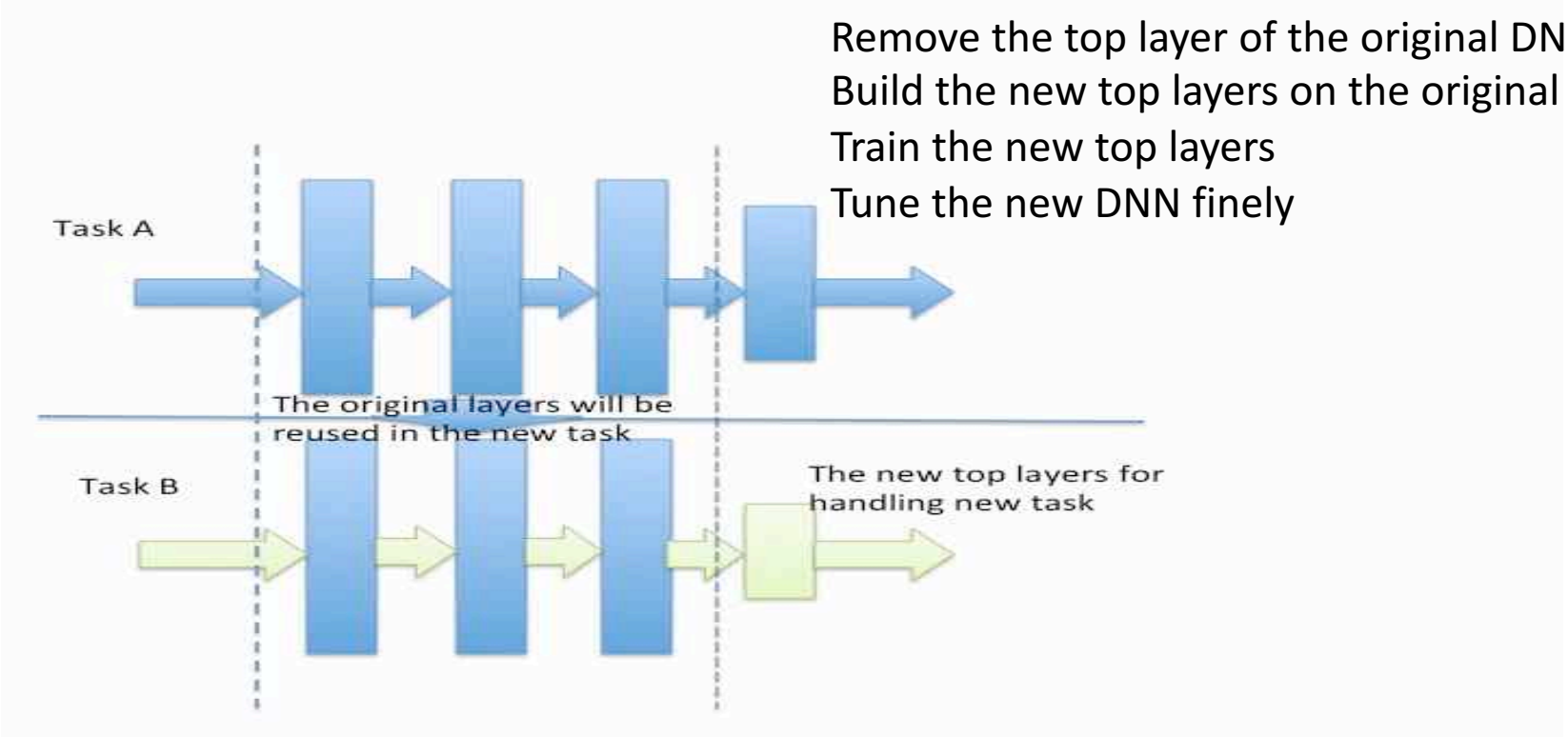
I see you.

No Bible for constructing DNN

Transfer Learning



Transfer Learning



Remove the top layer of the original DNN
Build the new top layers on the original DNN
Train the new top layers
Tune the new DNN finely

Where do you start from…

- Start from your case
- Start from your data
- Start from the simple

For More

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