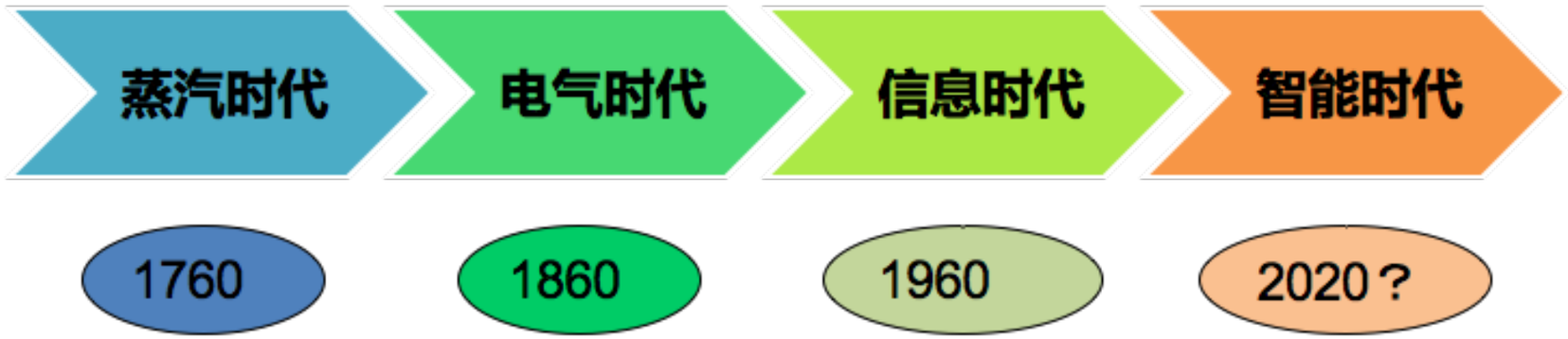
从 0 到1 ：机器学习的探索与实践

陈爱珍

- 机器学习概念
- 机器学习平台
- 人脸识别的实践

人工智能时代



未来人工智能将取代 **90%** 的职业

人脑学习 VS 机器学习

经验

归纳总结

当前现象 → 对比 → 规律 → 预测 → 未来

历史数据

训练

新的数据 → 输入 → 模型 → 预测 → 未知属性

机器学习可以解决的问题

- ## 分类问题

根据数据样本上抽取出的特征，判定其属于有限个类别中的哪一个。如图像内容识别识别。

- ## 回归问题

根据数据样本上抽取出的特征，预测一个连续值的结果。如票房预测。

- ## 聚类问题

根据数据样本上抽取出的特征，让样本抱抱团(相近/相关的样本在一团内)。如用户群体划分。

- ## 关联问题

根据数据样本上抽取出的特征，发现数据背后存在的某种规则或者联系。如交叉销售或者捆绑销售。

机器学习的应用

七牛云 QINIU | IT大咖说 不止于技术

计算机视觉

图片搜索
人脸识别
车牌识别
扫描文字识别
图片内容识别
视频内容识别

自然语言处理

搜索引擎智能匹配
文本内容理解
文本情绪判断
语音识别
输入法
机器翻译

精准营销

新闻推送
歌曲推荐
猜你喜欢
购买转化
商品推荐
针对性营销

社会网络分析

用户画像
网络关联分析
欺诈作弊发现
热点发现

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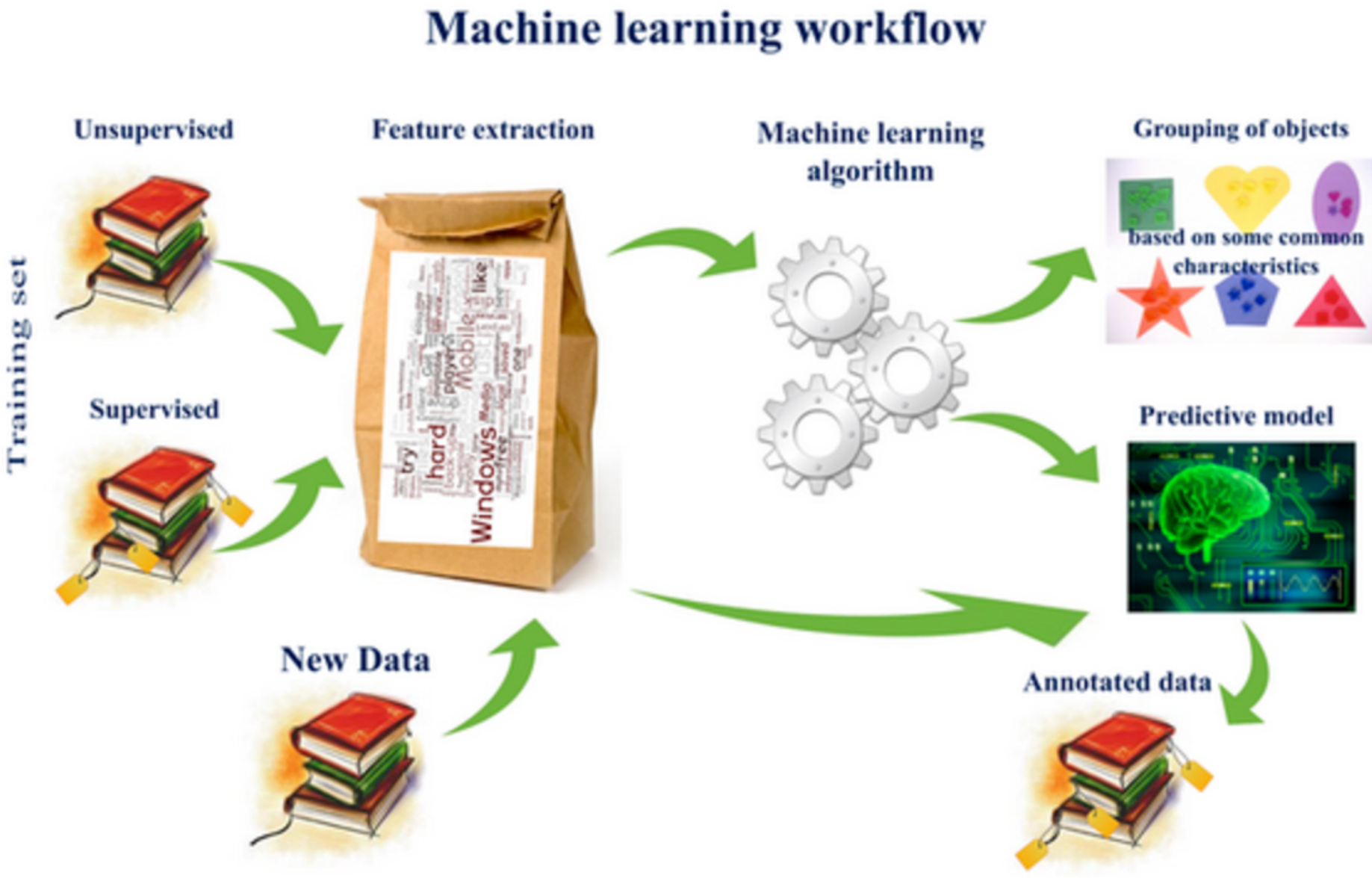
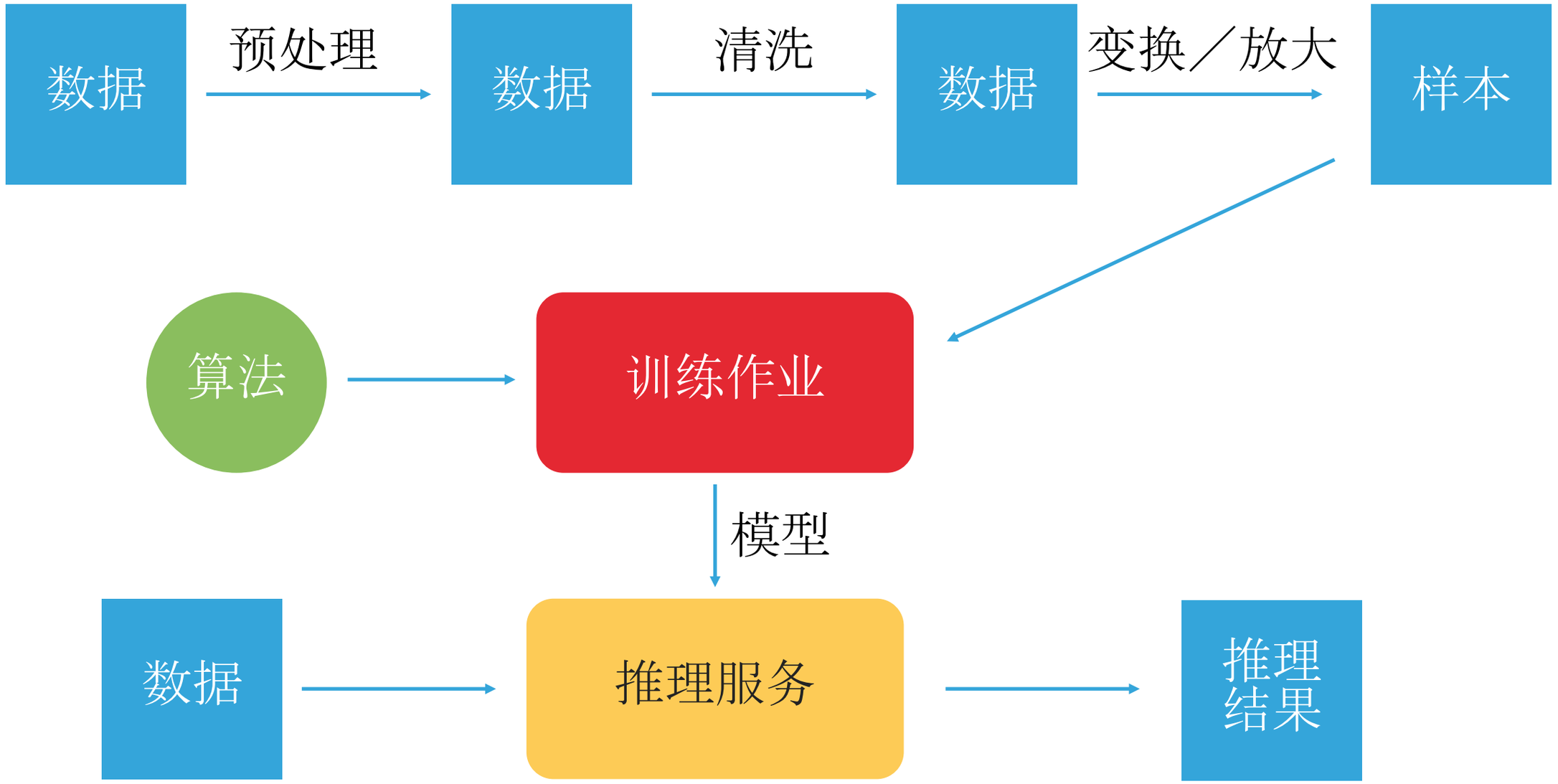
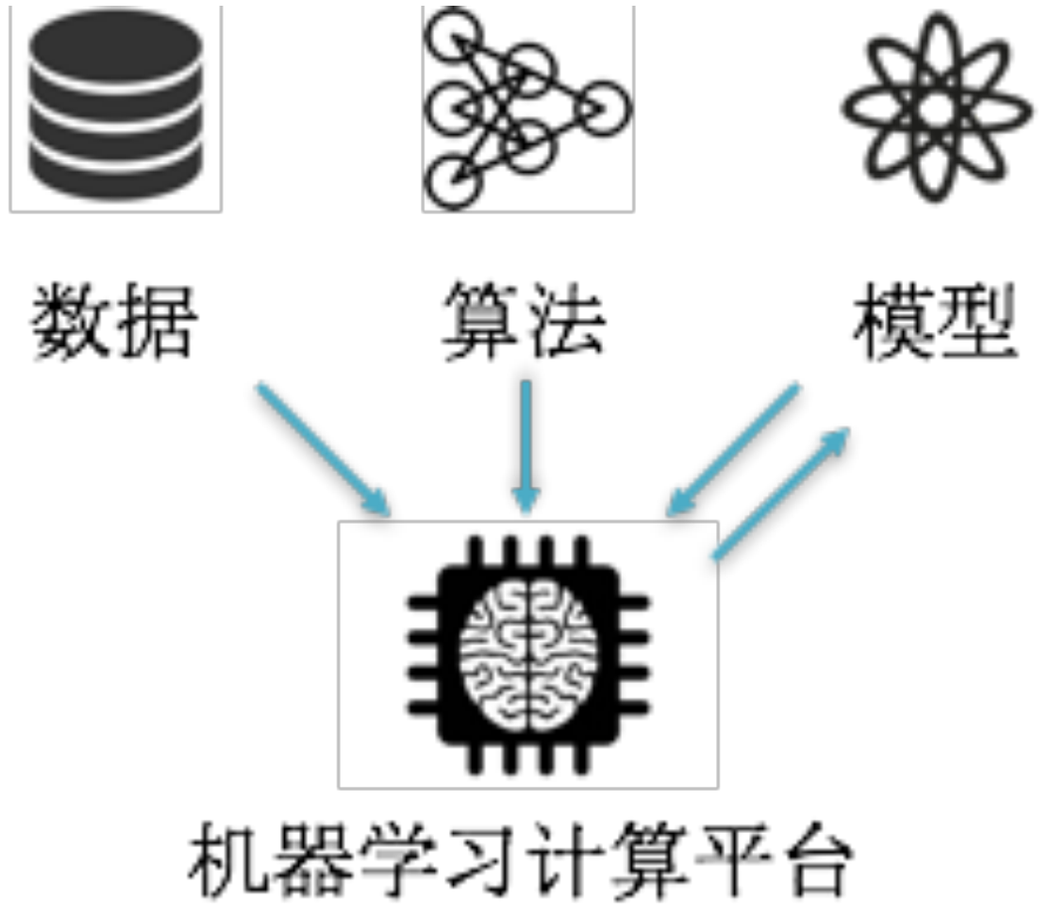
机器学习的工作流


Machine learning workflow
Unsupervised
Feature extraction
Machine learning algorithm
Grouping of objects
based on some common characteristics
Training set
Supervised
Predictive model
New Data
Annotated data

机器学习的工作流

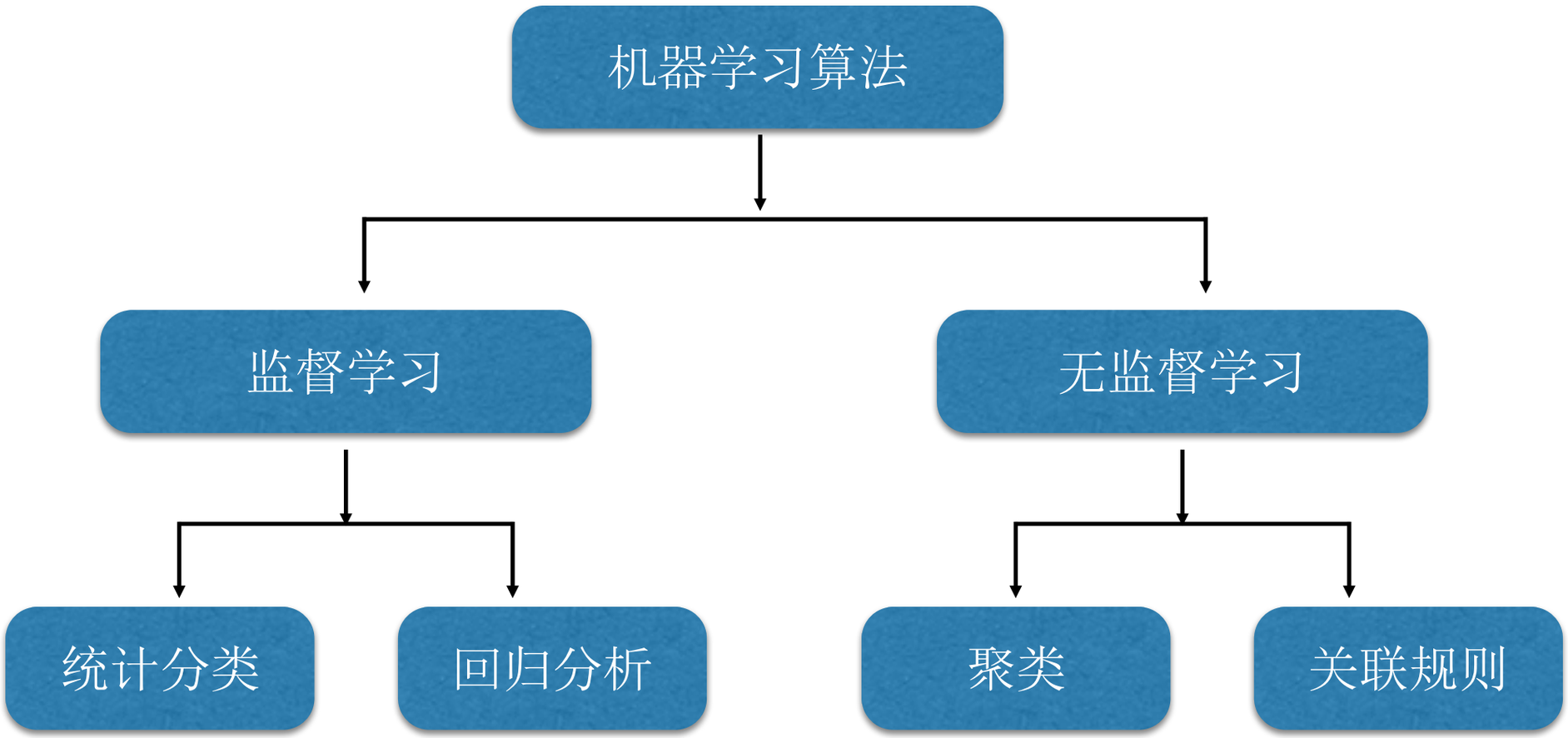


机器学习平台



通过数据预处理，深度学习算法，提供预训练模型和高效分布式算法平台生成的定制化模型。

机器学习的算法



用已知结果的数据做训练

不需要已知标签

机器学习的算法

- 决策树
- 随机森林算法
- 逻辑回归
- SVM
- 朴素贝叶斯
- K最近邻算法
- K均值算法
- Adaboost 算法
- 神经网络
- 马尔可夫

深度学习主流框架

TensorFlow 是一个比较低层的库，支持 Python 和 C++，也允许在 CPU 和 GPU 上的计算分布，甚至支持使用 gRPC 进行水平扩展。 TensorFlow 是一个非常好的框架，但是却非常低层。使用 TensorFlow 需要编写大量的代码，你必须一遍又一遍地重新发明轮子。

Theano 是一个比较低层的库，也因此它并不适合深度学习，而更适合数值计算优化。它支持自动的函数梯度计算，带有 Python 接口并集成了 Numpy。Theano 不支持多 GPU 和水平扩展

Keras 是一个非常高层的库，可以工作在 Theano 和 TensorFlow（可以配置）之上，只需几行代码就能构建一个神经网络。适合初学者进行实验和测试。

Torch 是 Facebook 的人工智能研究所用的框架，编程语言是 Lua，Torch 的核心是流行的神经网络，它使用简单的优化库，同时具有最大的灵活性，实现复杂的神经网络的拓扑结构。你可以建立神经网络和并行任意图，通过CPU和GPU等有效方式。

Caffe 非常稳健非常快速，适合生产的计算机视觉系统。缺点减不够灵活，文档非常贫乏，难安装，需要解决大量的依赖包。

mxnet 支持的言语包括 Python，R，C++，Julia 等。亚马逊 AWS 宣布选择 mxnet 作为其深度学习 AMI 的库，并宣称其巨大的横向扩展能力。

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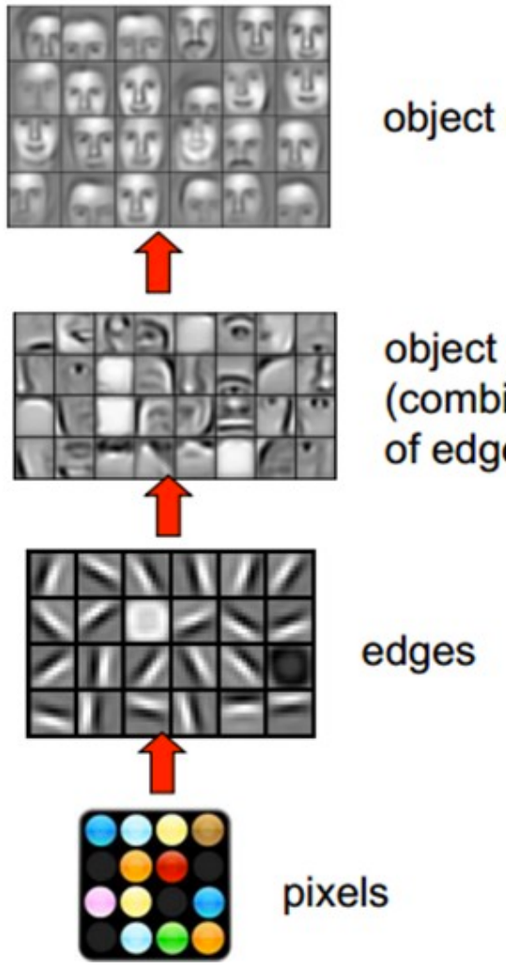
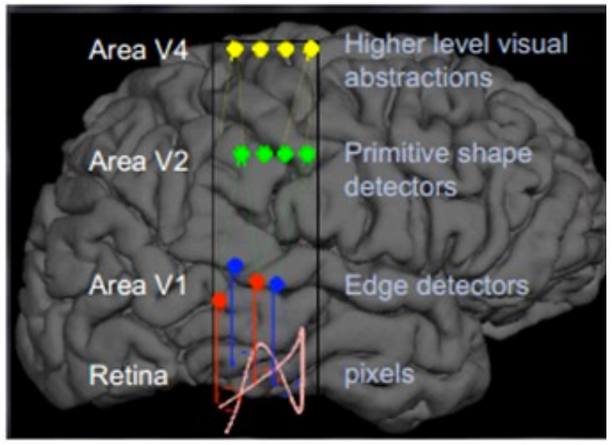
- **人脸识别的实践**

人的视觉系统



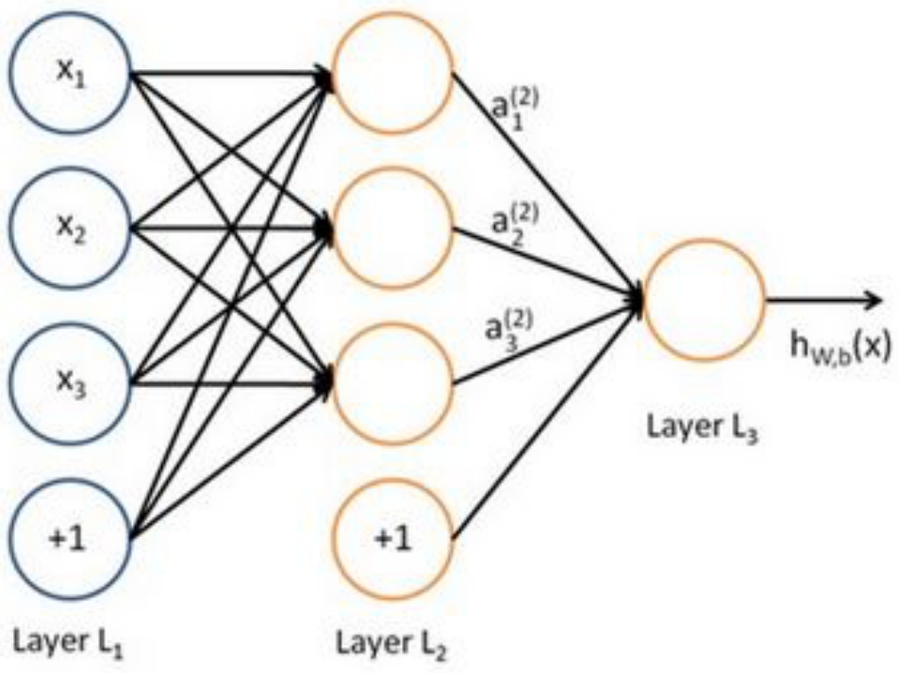


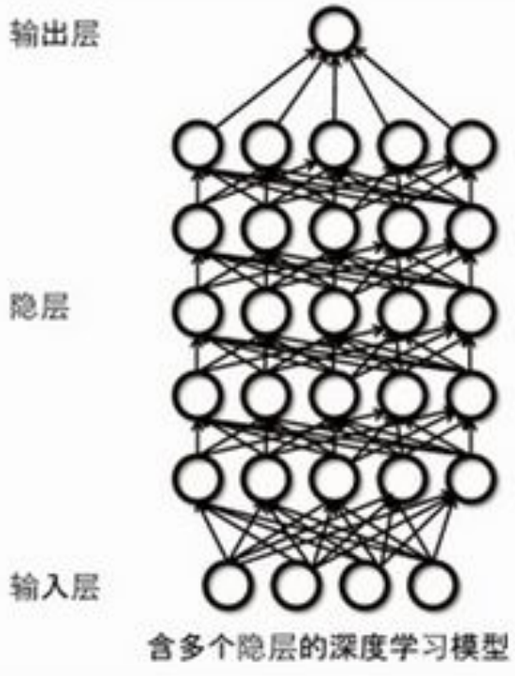
- 分级处理
- 高层的特征是低层特征的组合
- 层面越高越精确

人脑中有**150**多亿个神经元

神经网络

- 神经网络是一种模拟大脑的算法，是一类模式匹配算法。通常用于解决分类和回归问题。
- 是由具有适应性的简单单元组成的广泛并行互连的网络，它的组织能够模拟生物神经系统对真实世界物体所作出的交互反应。
- 神经网络是机器学习的一个庞大的分支，有几百种不同的算法。
- 深度学习就是其中的一类算法，深度学习试图建立大得多也复杂得多的神经网络。

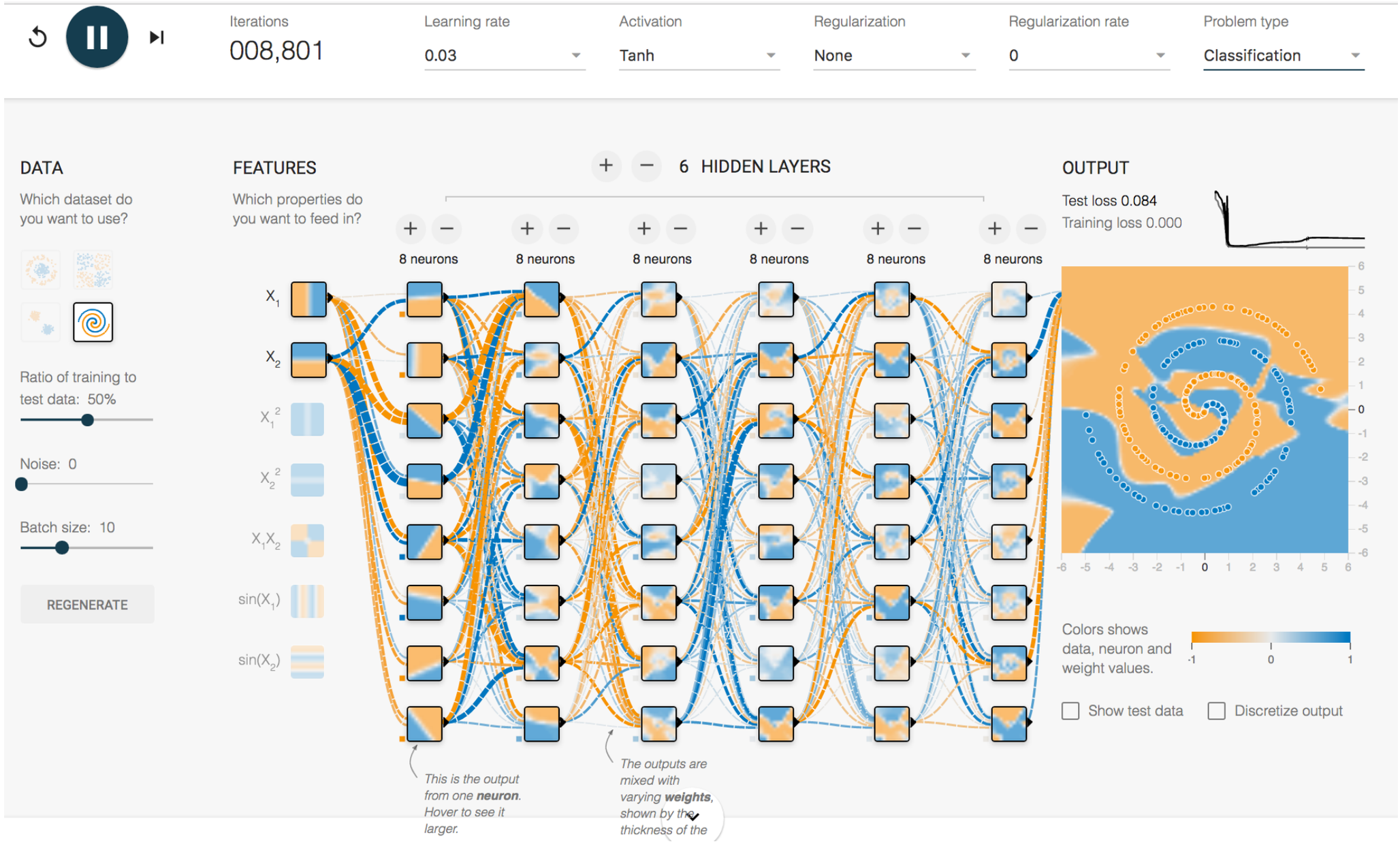




含多个隐层的深度学习模型

Google Tensorflow 游乐场

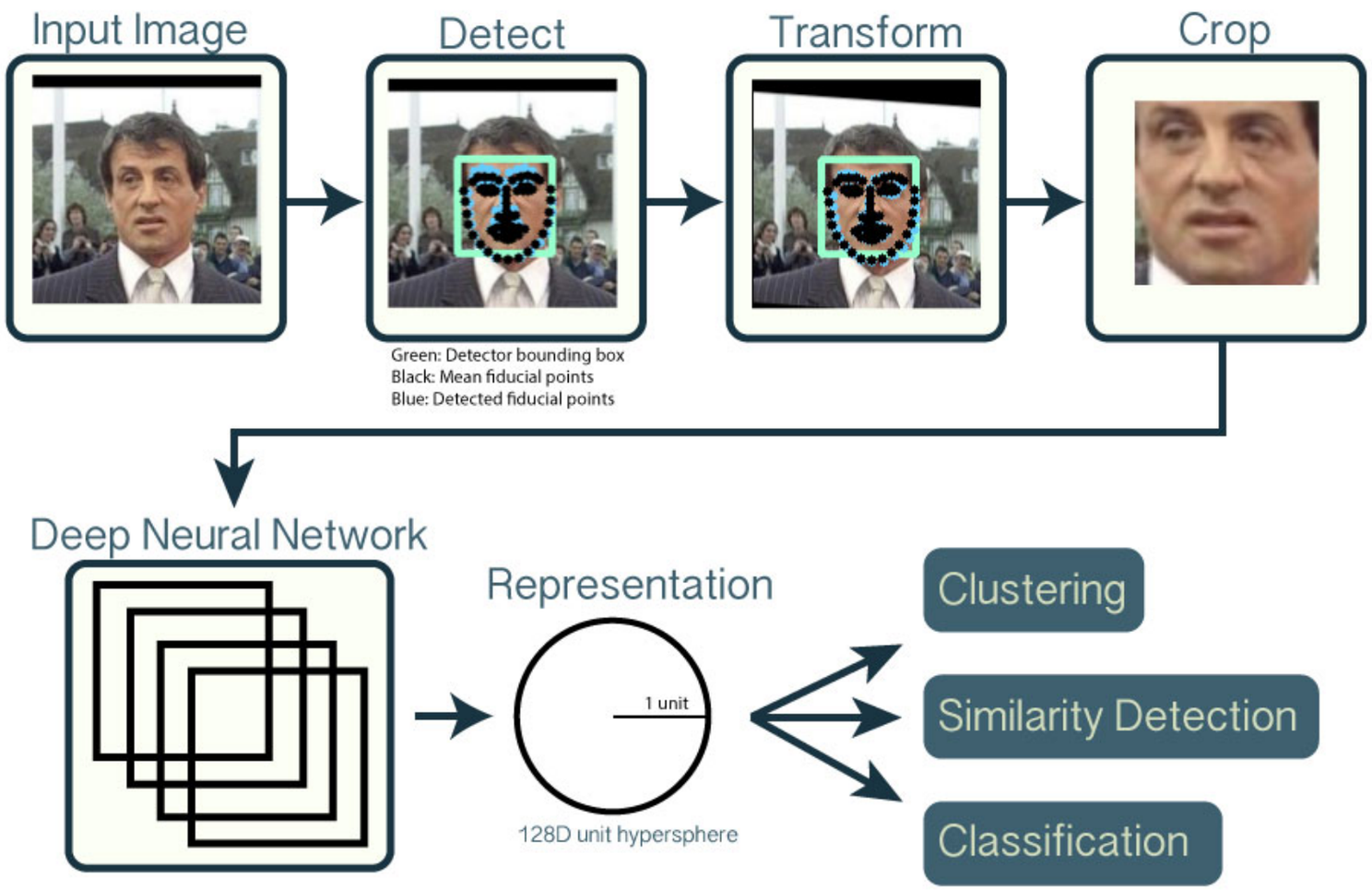
可以在浏览器中训练自己的神经网络，通过图像更直观地了解神经网络的工作原理：



http://playground.tensorflow.org/

开源项目 Openface 人脸识别实践

Openface 是用 Torch 和 Python 实现的一个基于深度神经网络的开源人脸识别系统。



https://cmusatyalab.github.io/openface/

四步完成人脸识别

1. 预处理：输入训练数据，裁剪脸部

./util/align-dlib.py ./training_images/ align outerEyesAndNose ./aligned-images/ --size 96

2.特征提取：对预处理的数据提取特征数据

./batch-represent/main.lua -outDir ./generated-embeddings/ -data ./aligned-images/

3.模型训练：根据特征生成分类器

./demos/classifier.py train ./generated-embeddings/

4.模型预估：使用分类器对新数据做评估

./demos/classifier.py infer ./generated-embeddings/classifier.pkl test_image.jpg

使用 docker 使用 Openface

```
[localhost:tmp chenaizhen$ docker search openface
NAME                                DESCRIPTION                                     STARS     OFFICIAL   AUTOMATED
bamos/openface                      OpenFace                                        28                   [OK]
harshjv/openface                    Face recognition with Google's FaceNet dee...   4                    [OK]
elihar/openface                     Modified version of bamos/openface              1
nightseas/openface                  CMU openface with CUDA.                         1                    [OK]
lilac/openface                                                                      0
wzdf1982/openface                   openface                                        0                    [OK]
uoacer/openface-mass-compare        An openface script that runs a REST server      0                    [OK]
askaditya619/openface               OpenFace tools and run over custom images       0
idinteraction/openface                                                              0
```

```
root@37538e999c61:/# cd root
root@37538e999c61:~# cd openface/
root@37538e999c61:~/openface# ls
CONTRIBUTING.md  LICENSE    api-docs          build    data   docs        images      models                          openface          run-tests.sh  tests     util
Dockerfile       README.md  batch-represent   cloc.sh  demos  evaluation  mkdocs.yml  opencv-dlib-torch.Dockerfile  requirements.txt  setup.py      training
```

1. 预处理：输入训练数据，裁剪脸部

```
[root@93aed3b1a312:~/openface/ML# /root/openface/util/align-dlib.py /root/openface/ML/training_images/ align outerEyesAndNose /root/openface/ML/aligned-images/ --size 96
=== /root/openface/ML/training_images/Pengmama/Pengmama20.jpg ===
=== /root/openface/ML/training_images/Pengmama/Pengmama18.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye15.jpg ===
=== /root/openface/ML/training_images/Pengmama/Pengmama8.jpg ===
=== /root/openface/ML/training_images/Pengmama/Pengmama3.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye1.jpg ===
=== /root/openface/ML/training_images/Trump/trump13.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye6.jpg ===
=== /root/openface/ML/training_images/Trump/trump2.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye10.jpg ===
=== /root/openface/ML/training_images/Hillary/Hillary19.jpg ===
=== /root/openface/ML/training_images/Mark/Mark10.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye14.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye4.jpg ===
=== /root/openface/ML/training_images/Pengmama/Pengmama19.jpg ===
=== /root/openface/ML/training_images/Obama/obama14.jpg ===
=== /root/openface/ML/training_images/Trump/trump14.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye5.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye12.jpg ===
=== /root/openface/ML/training_images/Jay/Jay12.jpg ===
=== /root/openface/ML/training_images/Obama/obama10.jpg ===
=== /root/openface/ML/training_images/Xidada/Xidada3.jpg ===
=== /root/openface/ML/training_images/Mark/Mark20.jpg ===
=== /root/openface/ML/training_images/Hillary/Hillary18.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye13.jpg ===
=== /root/openface/ML/training_images/Xidada/Xidada15.jpg ===
=== /root/openface/ML/training_images/Mark/Mark12.jpg ===
=== /root/openface/ML/training_images/Hillary/Hillary8.jpg ===
=== /root/openface/ML/training_images/Xidada/Xidada9.jpg ===
=== /root/openface/ML/training_images/Jay/Jay1.jpg ===
=== /root/openface/ML/training_images/Xidada/Xidada4.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye18.jpg ===
=== /root/openface/ML/training_images/Maoyeye/Maoyeye11.jpg ===
=== /root/openface/ML/training_images/Mark/Mark14.jpg ===
=== /root/openface/ML/training_images/Trump/trump6.jpg ===
=== /root/openface/ML/training_images/Obama/obama4.png ===
=== /root/openface/ML/training_images/Hillary/Hillary16.jpg ===
=== /root/openface/ML/training_images/Xidada/Xidada19.jpg ===
=== /root/openface/ML/training_images/Xidada/Xidada12.jpg ===
=== /root/openface/ML/training_images/Trump/trump18.jpg ===
```


Hillary1


Hillary2


Hillary3


Hillary4


Hillary5


Hillary6


Hillary7


Hillary8


Hillary9


Hillary10

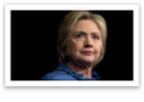

Hillary11

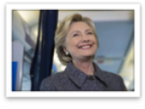

Hillary12


Hillary13


Hillary14


Hillary15


Hillary16


Hillary17


Hillary18


Hillary19


Hillary20


Hillary21


Hillary1.png


Hillary2.png


Hillary3.png


Hillary4.png


Hillary5.png


Hillary6.png


Hillary7.png


Hillary8.png


Hillary9.png


Hillary10.png


Hillary11.png


Hillary12.png


Hillary13.png


Hillary14.png


Hillary15.png


Hillary16.png


Hillary17.png


Hillary18.png


Hillary19.png

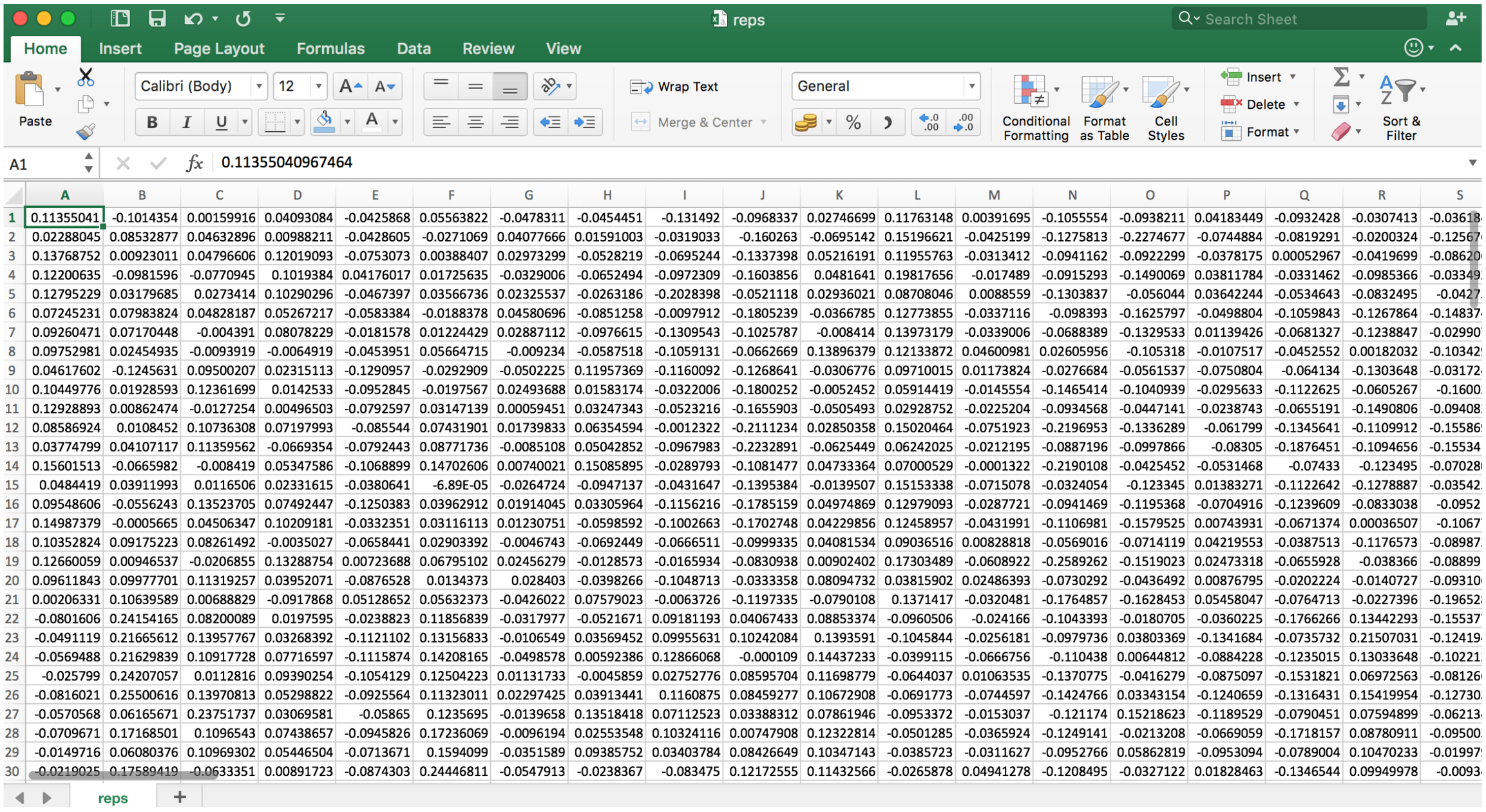
Hillary20.png

Hillary21.png

2.特征提取：对预处理的数据提取特征数据

```
root@93aed3b1a312:~/openface/ML# /root/openface/batch-represent/main.lua -outDir /root/openface/ML/generated-embeddings/ -data /root/openface/ML/aligned-images/
{
  data : "/root/openface/ML/aligned-images/"
  imgDim : 96
  model : "/root/openface/models/openface/nn4.small2.v1.t7"
  device : 1
  outDir : "/root/openface/ML/generated-embeddings/"
  cache : false
  cuda : false
  batchSize : 50
}
/root/openface/ML/aligned-images/
cache lotation:         /root/openface/ML/aligned-images/cache.t7
Creating metadata for cache.
{
  sampleSize :
    {
      1 : 3
      2 : 96
      3 : 96
    }
  split : 0
  verbose : true
  paths :
    {
      1 : "/root/openface/ML/aligned-images/"
    }
  samplingMode : "balanced"
  loadSize :
    {
      1 : 3
      2 : 96
      3 : 96
    }
}
running "find" on each class directory, and concatenate all those filenames into a single file containing all image paths for a given class
now combine all the files to a single large file
load the large concatenated list of sample paths to self.imagePath
154 samples found..... 0/154 .....]  ETA: 0ms | Step: 0ms
Updating classList and imageClass appropriately
 [========================================== 8/8 ==========================================>]  Tot: 204ms | Step: 25ms
Cleaning up temporary files
Splitting training and test sets to a ratio of 0/100
nImgs:  154
Represent: 50/154
Represent: 100/154
Represent: 150/154
```

2.特征提取：对预处理的数据提取特征数据



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	0.11355041	-0.1014354	0.00159916	0.04093084	-0.0425868	0.05563822	-0.0478311	-0.0454451	-0.131492	-0.0968337	0.02746699	0.11763148	0.00391695	-0.1055554	-0.0938211	0.04183449	-0.0932428	-0.0307413	-0.03618
2	0.02288045	0.08532877	0.04632896	0.00988211	-0.0428605	-0.0271069	0.04077666	0.01591003	-0.0319033	-0.160263	-0.0695142	0.15196621	-0.0425199	-0.1275813	-0.2274677	-0.0744884	-0.0819291	-0.0200324	-0.12567
3	0.13768752	0.00923011	0.04796606	0.12019093	-0.0753073	0.00388407	0.02973299	-0.0528219	-0.0695244	-0.1337398	0.05216191	0.11955763	-0.0313412	-0.0941162	-0.0922299	-0.0378175	0.00052967	-0.0419699	-0.08620
4	0.12200635	-0.0981596	-0.0770945	0.1019384	0.04176017	0.01725635	-0.0329006	-0.0652494	-0.0972309	-0.1603856	0.0481641	0.19817656	-0.017489	-0.0915293	-0.1490069	0.03811784	-0.0331462	-0.0985366	-0.03349
5	0.12795229	0.03179685	0.0273414	0.10290296	-0.0467397	0.03566736	0.02325537	-0.0263186	-0.2028398	-0.0521118	0.02936021	0.08708046	0.0088559	-0.1303837	-0.056044	0.03642244	-0.0534643	-0.0832495	-0.0427
6	0.07245231	0.07983824	0.04828187	0.05267217	-0.0583384	-0.0188378	0.04580696	-0.0851258	-0.0097912	-0.1805239	-0.0366785	0.12773855	-0.0337116	-0.098393	-0.1625797	-0.0498804	-0.1059843	-0.1267864	-0.14837
7	0.09260471	0.07170448	-0.004391	0.08078229	-0.0181578	0.01224429	0.02887112	-0.0976615	-0.1309543	-0.1025787	-0.008414	0.13973179	-0.0339006	-0.0688389	-0.1329533	0.01139426	-0.0681327	-0.1238847	-0.02990
8	0.09752981	0.02454935	-0.0093919	-0.0064919	-0.0453951	0.05664715	-0.009234	-0.0587518	-0.1059131	-0.0662669	0.13896379	0.12133872	0.04600981	0.02605956	-0.105318	-0.0107517	-0.0452552	0.00182032	-0.10342
9	0.04617602	-0.1245631	0.09500207	0.02315113	-0.1290957	-0.0292909	-0.0502225	0.11957369	-0.1160092	-0.1268641	-0.0306776	0.09710015	0.01173824	-0.0276684	-0.0561537	-0.0750804	-0.064134	-0.1303648	-0.03172
10	0.10449776	0.01928593	0.12361699	0.0142533	-0.0952845	-0.0197567	0.02493688	0.01583174	-0.0322006	-0.1800252	-0.0052452	0.05914419	-0.0145554	-0.1465414	-0.1040939	-0.0295633	-0.1122625	-0.0605267	-0.1600
11	0.12928893	0.00862474	-0.0127254	0.00496503	-0.0792597	0.03147139	0.00059451	0.03247343	-0.0523216	-0.1655903	-0.0505493	0.02928752	-0.0225204	-0.0934568	-0.0447141	-0.0238743	-0.0655191	-0.1490806	-0.09408
12	0.08586924	0.0108452	0.10736308	0.07197993	-0.085544	0.07431901	0.01739833	0.06354594	-0.0012322	-0.2111234	0.02850358	0.15020464	-0.0751923	-0.2196953	-0.1336289	-0.061799	-0.1345641	-0.1109912	-0.15586
13	0.03774799	0.04107117	0.11359562	-0.0669354	-0.0792443	0.08771736	-0.0085108	0.05042852	-0.0967983	-0.2232891	-0.0625449	0.06242025	-0.0212195	-0.0887196	-0.0997866	-0.08305	-0.1876451	-0.1094656	-0.15534
14	0.15601513	-0.0665982	-0.008419	0.05347586	-0.1068899	0.14702606	0.00740021	0.15085895	-0.0289793	-0.1081477	0.04733364	0.07000529	-0.0001322	-0.2190108	-0.0425452	-0.0531468	-0.07433	-0.123495	-0.07028
15	0.0484419	0.03911993	0.0116506	0.02331615	-0.0380641	-6.89E-05	-0.0264724	-0.0947137	-0.0431647	-0.1395384	-0.0139507	0.15153338	-0.0715078	-0.0324054	-0.123345	0.01383271	-0.1122642	-0.1278887	-0.03542
16	0.09548606	-0.0556243	0.13523705	0.07492447	-0.1250383	0.03962912	0.01914045	0.03305964	-0.1156216	-0.1785159	0.04974869	0.12979093	-0.0287721	-0.0941469	-0.1195368	-0.0704916	-0.1239609	-0.0833038	-0.0952
17	0.14987379	-0.0005665	0.04506347	0.10209181	-0.0332351	0.03116113	0.01230751	-0.0598592	-0.1002663	-0.1702748	0.04229856	0.12458957	-0.0431991	-0.1106981	-0.1579525	0.00743931	-0.0671374	0.00036507	-0.1067
18	0.10352824	0.09175223	0.08261492	-0.0035027	-0.0658441	0.02903392	-0.0046743	-0.0692449	-0.0666511	-0.0999335	0.04081534	0.09036516	0.00828818	-0.0569016	-0.0714119	0.04219553	-0.0387513	-0.1176573	-0.08987
19	0.12660059	0.00946537	-0.0206855	0.13288754	0.00723688	0.06795102	0.02456279	-0.0128573	-0.0165934	-0.0830938	0.00902402	0.17303489	-0.0608922	-0.2589262	-0.1519023	0.02473318	-0.0655928	-0.038366	-0.08899
20	0.09611843	0.09977701	0.11319257	0.03952071	-0.0876528	0.0134373	0.028403	-0.0398266	-0.1048713	-0.0333358	0.08094732	0.03815902	0.02486393	-0.0730292	-0.0436492	0.00876795	-0.0202224	-0.0140727	-0.09310
21	0.00206331	0.10639589	0.00688829	-0.0917868	0.05128652	0.05632373	-0.0426022	0.07579023	-0.0063726	-0.1197335	-0.0790108	0.1371417	-0.0320481	-0.1764857	-0.1628453	0.05458047	-0.0764713	-0.0227396	-0.19652
22	-0.0801606	0.24154165	0.08200089	0.0197595	-0.0238823	0.11856839	-0.0317977	-0.0521671	0.09181193	0.04067433	0.08853374	-0.0960506	-0.024166	-0.1043393	-0.0180705	-0.0360225	-0.1766266	0.13442293	-0.15537
23	-0.0491119	0.21665612	0.13957767	0.03268392	-0.1121102	0.13156833	-0.0106549	0.03569452	0.09955631	0.10242084	0.1393591	-0.1045844	-0.0256181	-0.0979736	0.03803369	-0.1341684	-0.0735732	0.21507031	-0.12419
24	-0.0569488	0.21629839	0.10917728	0.07716597	-0.1115874	0.14208165	-0.0498578	0.00592386	0.12866068	-0.000109	0.14437233	-0.0399115	-0.0666756	-0.110438	0.00644812	-0.0884228	-0.1235015	0.13033648	-0.10221
25	-0.025799	0.24207057	0.0112816	0.09390254	-0.1054129	0.12504223	0.01131733	-0.0045859	0.02752776	0.08595704	0.11698779	-0.0644037	0.01063535	-0.1370775	-0.0416279	-0.0875097	-0.1531821	0.06972563	-0.08126
26	-0.0816021	0.25500616	0.13970813	0.05298822	-0.0925564	0.11323011	0.02297425	0.03913441	0.1160875	0.08459277	0.10672908	-0.0691773	-0.0744597	-0.1424766	0.03343154	-0.1240659	-0.1316431	0.15419954	-0.12730
27	-0.0570568	0.06165671	0.23751737	0.03069581	-0.05865	0.1235695	-0.0139658	0.13518418	0.07112523	0.03388312	0.07861946	-0.0953372	-0.0153037	-0.121174	0.15218623	-0.1189529	-0.0790451	0.07594899	-0.06213
28	-0.0709671	0.17168501	0.1096543	0.07438657	-0.0945826	0.17236069	-0.0096194	0.02553548	0.10324116	0.00747908	0.12322814	-0.0501285	-0.0365924	-0.1249141	-0.0213208	-0.0669059	-0.1718157	0.08780911	-0.09500
29	-0.0149716	0.06080376	0.10969302	0.05446504	-0.0713671	0.1594099	-0.0351589	0.09385752	0.03403784	0.08426649	0.10347143	-0.0385723	-0.0311627	-0.0952766	0.05862819	-0.0953094	-0.0789004	0.10470233	-0.01997
30	-0.0219025	0.17589419	-0.0633351	0.00891723	-0.0874303	0.24446811	-0.0547913	-0.0238367	-0.083475	0.12172555	0.11432566	-0.0265878	0.04941278	-0.1208495	-0.0327122	0.01828463	-0.1346544	0.09949978	-0.0093

3.模型训练：根据特征生成分类器

```
[root@93aed3b1a312:~/openface/ML# /root/openface/demos/classifier.py train /root/openface/ML/generated-embeddings/
/usr/local/lib/python2.7/dist-packages/sklearn/lda.py:4: DeprecationWarning: lda.LDA has been moved to discriminant_analysis.LinearDiscriminantAnalysis in 0.17 and will be removed i
n 0.19
  "in 0.17 and will be removed in 0.19", DeprecationWarning)
Loading embeddings.
Training for 8 classes.
Saving classifier to '/root/openface/ML/generated-embeddings//classifier.pkl'
```

4.模型预估：使用分类器对新数据做评估

```
[root@93aed3b1a312:~/openface/ML# /root/openface/demos/classifier.py infer /root/openface/ML/generated-embeddings/classifier.pkl  /root/openface/ML/test_images/obama_test.jpg
/usr/local/lib/python2.7/dist-packages/sklearn/lda.py:4: DeprecationWarning: lda.LDA has been moved to discriminant_analysis.LinearDiscriminantAnalysis in 0.17 and will be removed i
n 0.19
  "in 0.17 and will be removed in 0.19", DeprecationWarning)

=== /root/openface/ML/test_images/obama_test.jpg ===
Predict Obama with 0.66 confidence.
```

在线预测系统

基于七牛自定义数据处理平台搭建一个简单的的深度学习在线预测系统，帮助提供基本的在线预测服务。

Demo 演示