



Распознавание образов и приближенные множества



- По материалам конференций:*
1. Iberian Conference on Pattern Recognition and Image Analysis (IbPRIA 2017), г. Фару (Португалия), 20.06 - 23.06,
Web: <http://www.ibpria.org/2017/>



2. International Joint Conference on Rough Sets (IJCRS 2017), Ольштын (Польша), 03.07 - 07.07,
Web: <http://ijcrs2017.uwm.edu.pl>

1. IbPRIA 2017

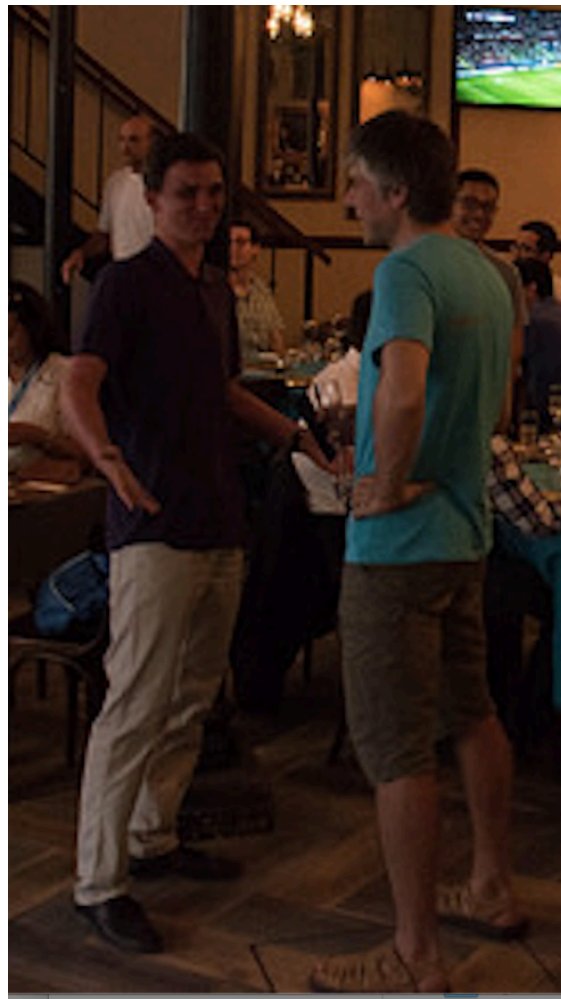
2. IJCRS 2017



Weakly-supervised learning from images and video


Ivan Laptev

WILLOW, INRIA/ENS/CNRS, Paris



Задача weakly-supervised object detection

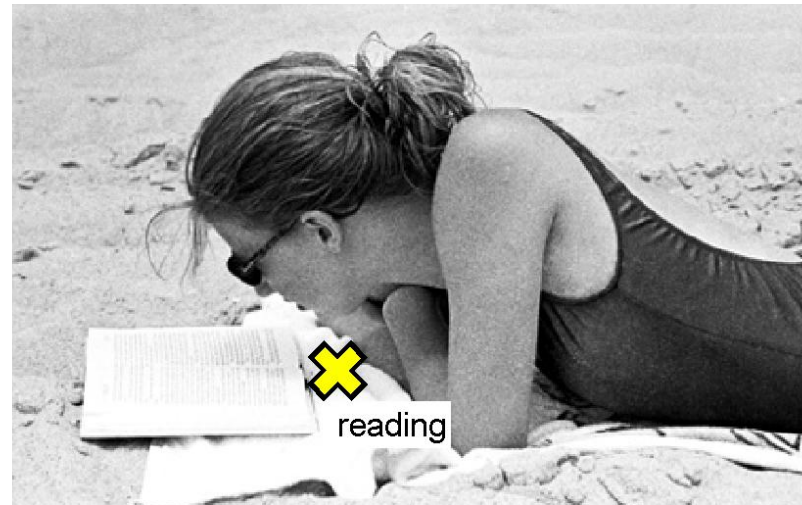
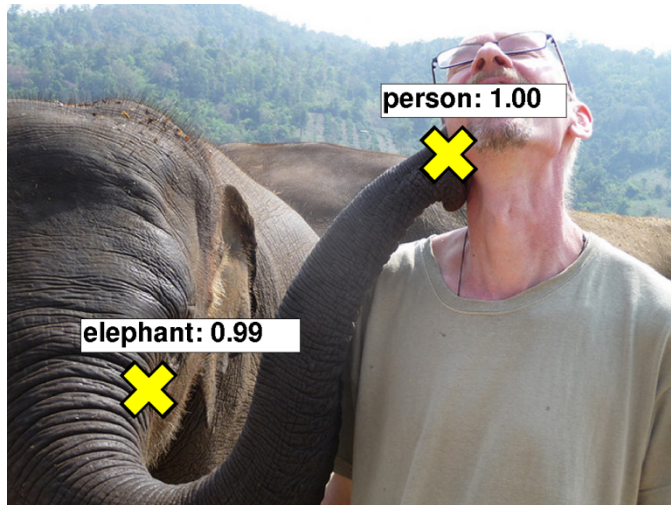
Training input



+

✓ Person	✓ Reading
✓ Chair	✗ Riding bike
✗ Airplane	✗ Running
...	...

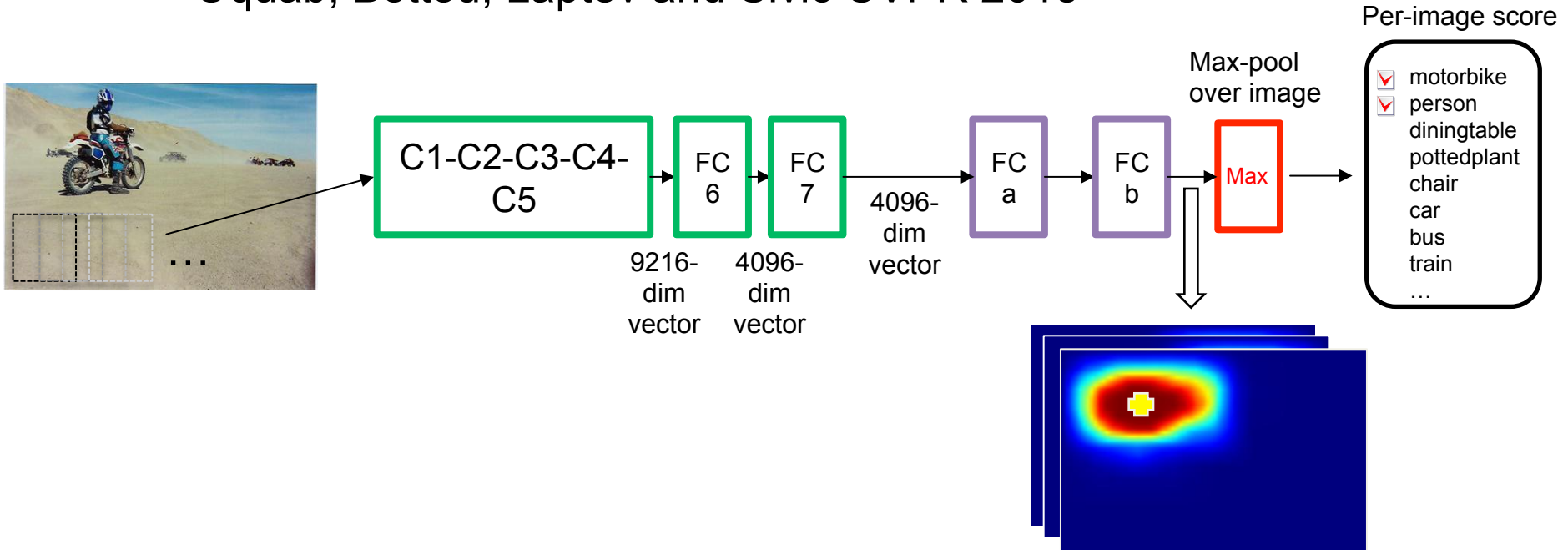
Test output



More details in <http://www.di.ens.fr/willow/research/weakcnn/>

Approach: search over object's location at the training time

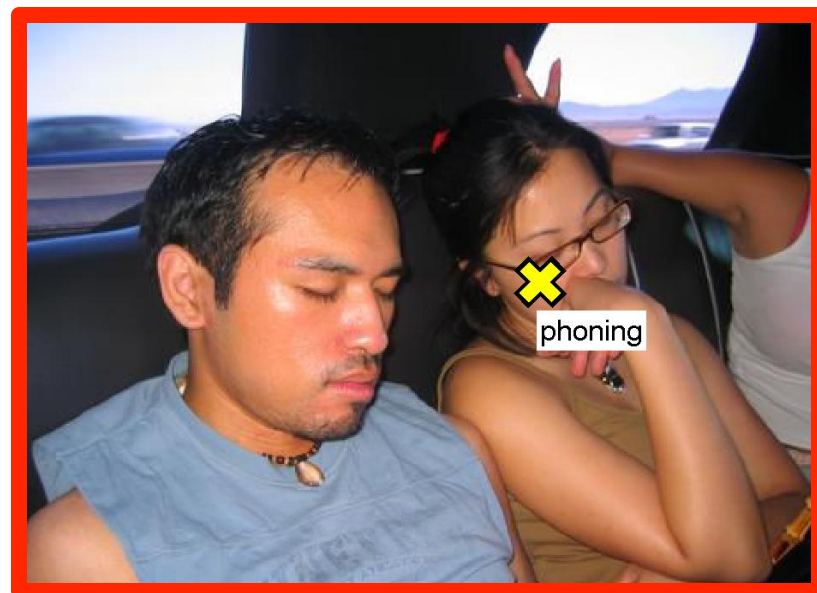
Oquab, Bottou, Laptev and Sivic CVPR 2015



1. Fully convolutional network
2. Image-level aggregation (max-pool)
3. Multi-label loss function (allow multiple objects in image)

See also [Papandreou et al. '15, Sermanet et al. '14, Chaftfield et al.'14]

Action recognition



Weak supervision from scripts:




Joint Learning of Actors and Actions

[Bojanowski et al. ICCV 2013],[Miech, Alayrac, Bojanowski, Laptev, Sivic, 2017]

$$\min_{Z, T, w, b, v, c}$$

$$\frac{1}{N} \|Z - \phi(X)w - b\|_F^2 + \lambda_1 \text{Tr}(w^T w)$$

$$+ \frac{1}{N} \|T - \psi(X)v - c\|_F^2 + \lambda_2 \text{Tr}(v^T v)$$

z_{11}	\dots	z_{1p}	\dots	z_{1P}		t_{11}	\dots	t_{1a}	\dots	t_{1A}
\vdots		\vdots		\vdots		\vdots		\vdots		\vdots
$z_{n_1 1}$	\dots	$z_{n_1 p}$	\dots	$z_{n_1 P}$		$t_{n_1 1}$	\dots	$t_{n_1 a}$	\dots	$t_{n_1 A}$
$z_{n_2 1}$	\dots	$z_{n_2 p}$	\dots	$z_{n_2 P}$		$t_{n_2 1}$	\dots	$t_{n_2 a}$	\dots	$t_{n_2 A}$
$z_{n_3 1}$	\dots	$z_{n_3 p}$	\dots	$z_{n_3 P}$		$t_{n_3 1}$	\dots	$t_{n_3 a}$	\dots	$t_{n_3 A}$
\vdots		\vdots		\vdots		\vdots		\vdots		\vdots
z_{N1}	\dots	z_{Np}	\dots	z_{NP}		t_{N1}	\dots	t_{Na}	\dots	t_{NA}

Person p *p = Rick*
appears in **clip N** :

Action a appears in
clip N :

Person p and *a = Walk*
Action a appear in **clip N** :

$$\sum_{n \in \mathcal{N}_i} z_{np} \geq 1$$

$$\sum_{n \in \mathcal{N}_i} t_{na} \geq 1$$

$$\sum_{n \in \mathcal{N}_i} z_{np} t_{na} \geq 1$$

Learning from narrated instruction videos

J.-B. Alayrac, P. Bojanowski, N. Agrawal, J. Sivic, I. Laptev and S. Lacoste-Julien

CVPR 2016

Given a set of **narrated** instruction videos of a task

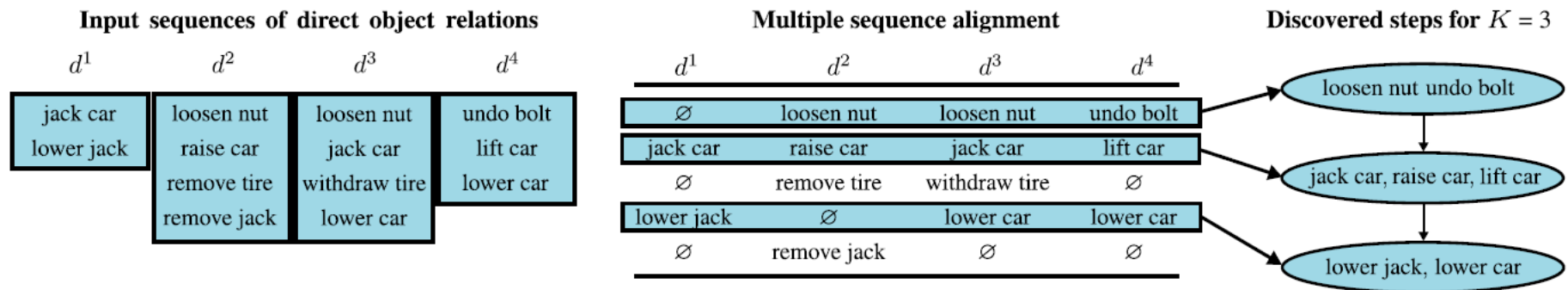
- Discover **main steps**
- Learn their **visual** and **linguistic** representation
- **Temporally localize** each step in input videos



"How to" instruction videos: changing tire

Approach: two linked clustering problems

1. Text clustering into a **sequence** of common steps



2. Video clustering to **localize the actions** with text constraints

$$h(Z) = \min_{W \in \mathbb{R}^{K \times d}} \underbrace{\frac{1}{2T} \|Z - XW\|_F^2}_{\text{Discriminative loss on data}} + \underbrace{\frac{\lambda}{2} \|W\|_F^2}_{\text{Regularizer}} \quad \text{s.t.} \quad \underbrace{Z \in \mathcal{Z}}_{\text{ordered script}}, \quad \underbrace{AZ \geq R}_{\text{weak textual constraints}}.$$

Discovered temporal localization [TxK matrix]
Representation of video chunks (IDTF, CNN) [Txd] matrix
Linear action classifier [dxK] matrix
Temporal constraints from text

Large-scale video tagging

A. Miech, J. Sivic, I. Laptev, 2017

Featured Prediction Competition

Google Cloud & YouTube-8M Video Understanding Challenge

Can you produce the best video tag predictions?

\$100,000 Prize Money

Google Cloud · 650 teams · 3 days ago

Overview Data Kernels Discussion **Leaderboard** More

[Submit Predictions](#)

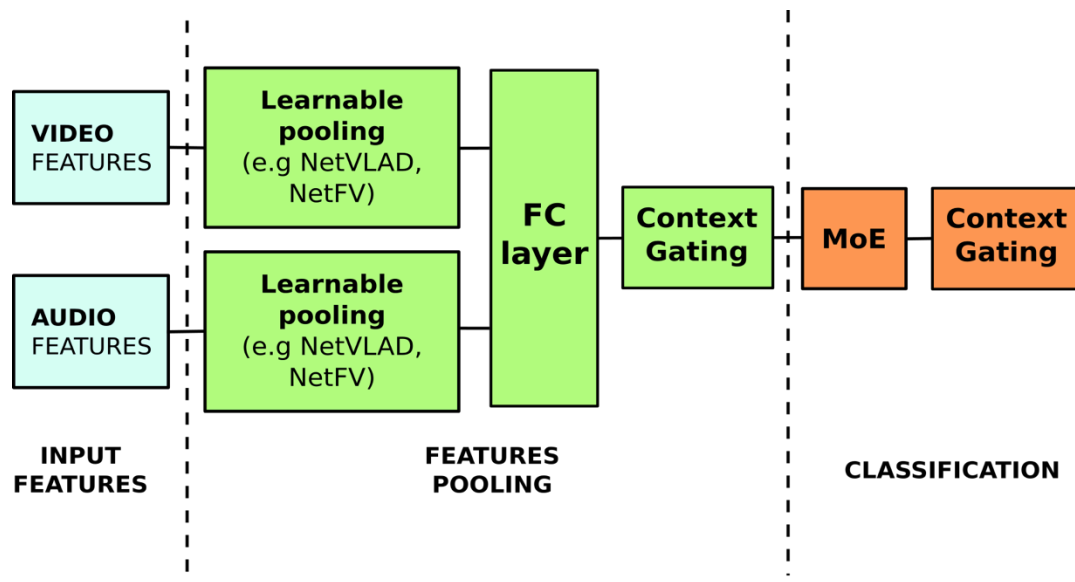
Public Leaderboard

Private Leaderboard

The private leaderboard is calculated with approximately 50% of the test data.
This competition has completed. This leaderboard reflects the final standings.

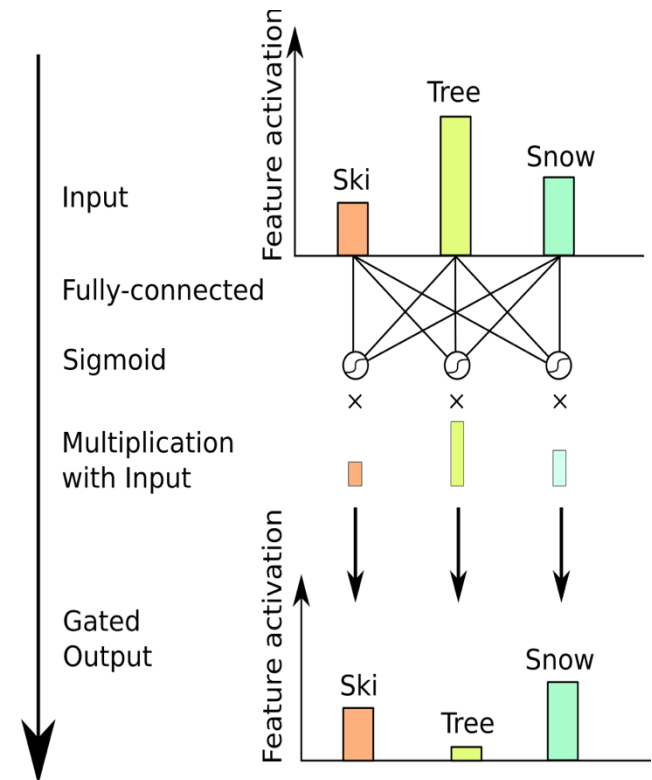
[Refresh](#)

#	Δpub	Team Name ★ in the money	Kernel	Team Members	Score	Entries	Last
1	—	★ WILLOW			0.84967	23	4d
2	—	★ monkeytyping			0.84590	88	3d
3	—	★ offline			0.84542	96	3d



Details in <http://arxiv.org/abs/1706.06905>

Context Gating



Cost Sensitive Boosting Algorithms: Do we really need them?

Gavin Brown, University of Manchester

Cost sensitive problems – differing cost for a False Positive / False Negative

Sorry, lots of people got there first...

AdaBoost (Freund & Schapire 1997)
AdaCost (Fan et al. 1999)
AdaCost(β_2) (Ting 2000)
CSB0 (Ting 1998)
CSB1 (Ting 2000)
CSB2 (Ting 2000)
AdaC1 (Sun et al. 2005, 2007)
AdaC2 (Sun et al. 2005, 2007)
AdaC3 (Sun et al. 2005, 2007)
CSAd (Landesa-Vázquez & Vasconcelos 2007, 2011)
AdaDE (Landesa-Vázquez & Alba-Castro 2013)
AdaMEC (Ting 2000, Nikolaou & Brown 2015)
CGAda (Landesa-Vázquez & Alba-Castro 2012, 2015)
AsymAda (Viola & Jones 2002)

15+ boosting variants
over 20 years

Invented
multiple times

Most proposed as
heuristic modifications
to original algorithm

Each has its own
justifications, its own
favorite datasets ...

Who should we trust?!

<http://www.di.uoa.gr/sites/default/files/BoostingTalkAthens.pdf>

<https://link.springer.com/article/10.1007/s10994-016-5572-x>

Почему AdaBoost интересен?

- Functional Gradient Descent (Mason et al., 2000)
- Decision Theory (Freund & Schapire, 1997)
- Margin Theory (Schapire et al., 1998)
- Probabilistic Modeling (Lebanon & Lafferty 2001; Edakunni et al 2011)



My new algorithm

Functional Gradient Descent



Decision Theory



Margin Theory

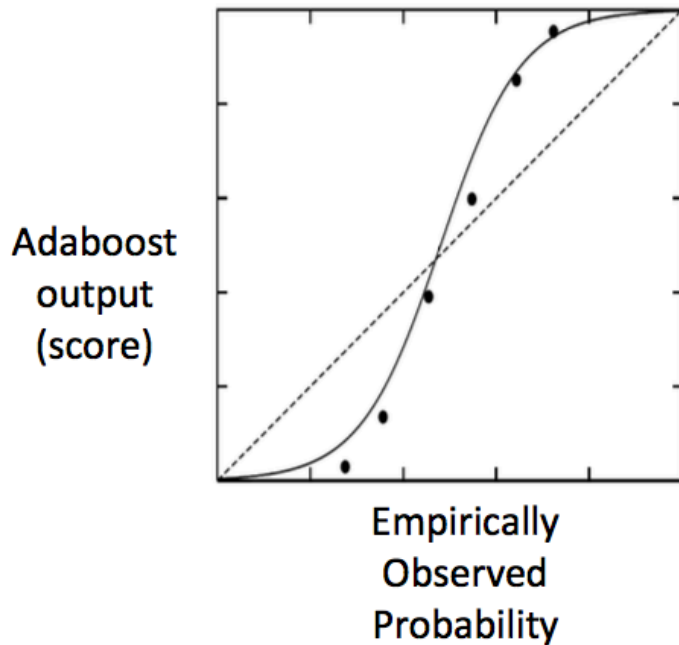


Probabilistic Modelling

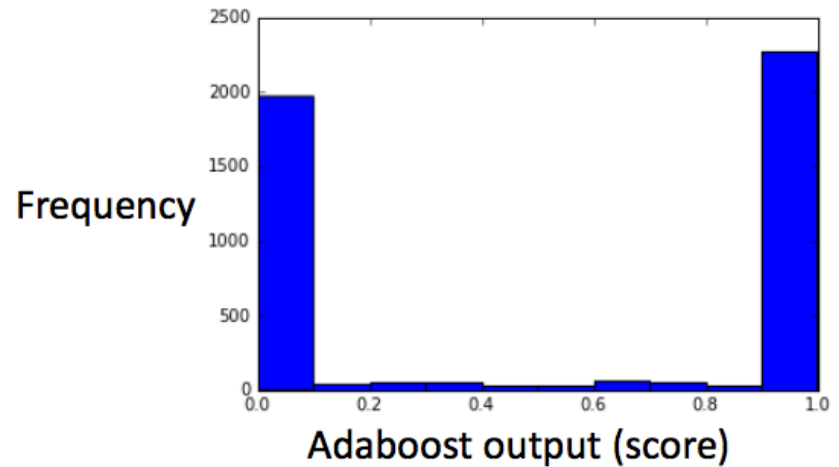


*"Does my new algorithm
still follow from each?"*

Калибровка оценок апостериорных вероятностей (1)



Adaboost tends to produce probability estimates close to 0 or 1.



Property: Calibrated estimates

Does the algorithm generate “calibrated” probability estimates?

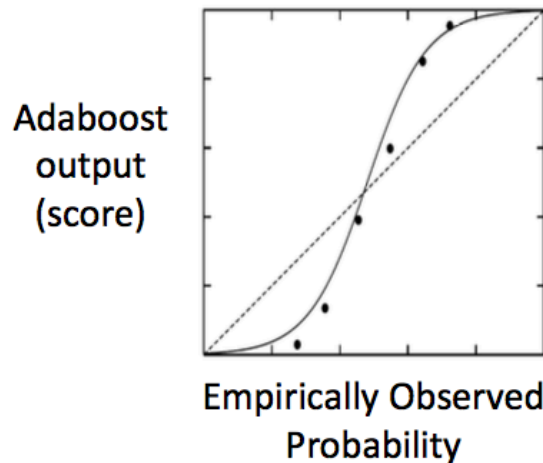
All algorithms produce uncalibrated probability estimates!

Калибровка оценок апостериорных вероятностей (2)

Platt scaling (logistic calibration)

(Platt, 1999)

Training: Reserve part of training data (here 50% -more on this later) to **fit a sigmoid** to correct the distortion:



$$\hat{p}(y = 1 | \mathbf{x}) = \frac{1}{1 + e^{As(\mathbf{x}) + B}}$$

Параметры A, B
определяются с
помощью метода
максимума
правдоподобия

Prediction: Apply sigmoid transformation to **score** (output of ensemble) to get **probability estimate**

Recognizing Activities of Daily Living from Egocentric Images

Alejandro Cartas, Juan Marin, Petia Radeva, Mariella Dimiccoli

University of Barcelona

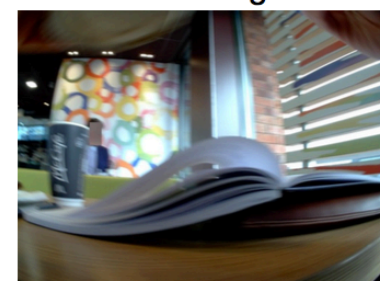
Drinking/eating alone



Meeting



Reading



Egocentric (first-person) wearable cameras

AlexNet Top 5

#	Activity	Score
1	Public Transport	0.1864
2	Cooking	0.1464
3	Eating together	0.1382
4	Drinking/eating alone	0.1223
5	Cleaning and chores	0.1067

AlexNet Top 5

#	Activity	Score
1	Talking	0.2034
2	Meeting	0.1701
3	Cooking	0.1090
4	Cleaning and chores	0.0903
5	Shopping	0.0878

AlexNet Top 5

#	Activity	Score
1	Drinking/eating alone	0.5002
2	Cleaning and chores	0.1511748880
3	Eating together	0.1263086796
4	Shopping	0.0589886233
5	Drinking together	0.0251834411

GoogLeNet Top 5

#	Activity	Score
1	Plane	0.2004
2	Public Transport	0.1943
3	Cleaning and chores	0.1450
4	Cooking	0.0925
5	Drinking/eating alone	0.0748

GoogLeNet Top 5

#	Activity	Score
1	Eating together	0.3065
2	Talking	0.1215
3	Socializing	0.1062
4	Cleaning and chores	0.08126
5	Meeting	0.0664

GoogLeNet Top 5

#	Activity	Score
1	Cleaning and chores	0.4259
2	Eating together	0.1145323068
3	Drinking/eating alone	0.1137253270
4	Drinking together	0.0841688886
5	Reading	0.06203

The result of the ensembles AlexNet+RF on FC6 and GoogLeNet+RF on Pool5/7x7+prob is highlighted on color in its corresponding table.

The green and red colors means true positive and false positive classification

1. IbPRIA 2017

2. IJCRS 2017



20.VII.1944 - ZAMACH - ATTENTAT - ASSASINATION ATTEMPT



Plk. Claus von Stauffenberg

8:00 Szef sztabu armii zapasowej plk. Claus von Stauffenberg wraz z adiutantem por. W. Heaftenem z lotniska Rangsdorf pod Berlinem samolotem udaje się na naradę do Wilczego Szańca. Ma tam przedstawić Hitlerowi koncepcję użycia armii rezerwowej na froncie wschodnim.

10:15 Samolot ląduje na lotnisku pod Kętrzynem, skąd samochodem obaj przyjeżdżają do kwatery Stauffenberga ma w teczce dwie bomby z zapalnikami chemicznymi.

11:30 Narada wstępna u feldmarszałka W. Keitel.

12:20

Stauffenberg przy pomocy adiutanta

uzbraja jedną bombę (drugiej nie zdążył) i udaje

się z nią do baraku narad. Tam tęczy z bombą.



Barak narad po wybuchu

Blick in den Lagebesprechungsraum in der Lagebaracke nach dem Attentat am 20. Juli 1944



Przybliżone miejsca, zajmowane przez uczestników narady 20 lipca 1944 r.

1. Adolf Hitler
2. Gen. Adolf Heusinger, szef oddziału operacyjnego wojsk lądowych
3. Gen. Günther Korten, szef sztabu generalnego wojsk lądowych
4. Plk Heinz Brandt z-ca gen. Adolfa Heusingera
5. Gen. Karl Bodenschatz, przedstawiciel naczelnego dowództwa wojsk lądowych
6. Plk Heinz Waizenegger, adiutant feldmarszałka Keitla

Situationsskizze der Lagebesprechung am 20. Juli 1944

1. Adolf Hitler
2. Generalleutnant A. Heusinger
3. General der Flieger G. Korten
4. Oberst i. G. H. Brandt
5. General der Flieger K. H. Bodenschatz
6. Oberstleutnant G. H. Waizenegger
7. Generalleutnant R. Schmudt



Zdjęcie drewnianego baraku obudowanego cegłą i betonem

H. Göring im Gespräch mit A. Hitler's persönlichen Adjutanten SS-Führer Julius Schaub; vorn: General der Flieger Bruno Loezer (links) und Reichsleiter M. Bormann (rechts), am 20. Juli 1944



Toward data-driven education (1)

Rakesh Agrawal, Microsoft

Задачи:

1. A study plan is the choice of concepts and the organization and sequencing of the concepts in an educational course.
Task: Identify which concepts should be studied together and how students should move from one group of concepts to another.

A data-driven method, which given a list of concepts can automatically propose candidate plans to cover all the concepts.
[Journal of Educational Data Mining, 2016]

2. How to enhance the quality of the electronic textbooks? [ACM DEV 2010]

3. Grouping Students for Maximizing Learning from Peers [Educational Data Mining 2017]



Toward data-driven education (2).

Структурирование учебника

Video Augmentation: Make inaccessible accessible

Table of contents for navigating the book
(*automatically extracted*)

Re-rendered section: This section, about the laws of chemical combination, prescribes an activity for the chemistry lab, but the school might lack the lab to do the experiments

Augmentations panel:
Video demonstrates the reaction for the second set of chemicals prescribed

← Science

- Matter in Our Surroundings
- Is Matter Around Us Pure
- Atoms and Molecules ✓
- Structure of the Atom
- The Fundamental Unit of Life
- Tissues
- Diversity in Living Organisms
- Motion

3.1: Atoms and Molecules: Laws of Chemical Combination

Chapter 3

ATOMS AND MOLECULES

Ancient Indian and Greek philosophers have always wondered about the unknown and unseen form of matter. The idea of divisibility of matter was considered long back in India, around 500 BC. An Indian philosopher Maharishi Kanad, postulated that if we go on dividing matter (*padarth*), we shall get smaller and smaller particles. Ultimately, a time will come when we shall come across the smallest particles beyond which further division will not be possible. He named these particles *Parmanu*. Another Indian philosopher, Pakudha Katyayama, elaborated this doctrine and said that these particles normally exist in a combined form which gives us various forms of matter.

Around the same era, ancient Greek philosophers – Democritus and Leucippus suggested that if we go on dividing matter, a stage will come when particles obtained cannot be divided further. Democritus called these indivisible particles atoms (meaning indivisible). All this was based on philosophical considerations and not much experimental work to validate these ideas could be done till the eighteenth century.

By the end of the eighteenth century, scientists recognised the difference between elements and compounds and naturally became interested in finding out how and why elements combine and what happens when they combine.

Antoine L. Lavoisier laid the foundation of chemical sciences by establishing two important laws of chemical combination.

3.1 Laws of Chemical Combination

The following two laws of chemical combination were established after much

experimentations by Lavoisier and Joseph L. Proust.

3.1.1 LAW OF CONSERVATION OF MASS

Is there a change in mass when a chemical change (chemical reaction) takes place?

Activity 3.1

Take one of the following sets, X and Y of chemicals—

X	Y
(i) copper sulphate	sodium carbonate
(ii) barium chloride	sodium sulphate
(iii) lead nitrate	sodium chromate

Prepare separately a 5% solution of any one pair of substances listed under X and Y in water.

Take a little amount of solution of Y in a conical flask and some solution of X in an ignition tube.

Hang the ignition tube in the flask carefully; see that the solutions do not get mixed. Put a cork on the flask (see Fig. 3.1).

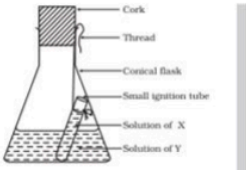


Fig. 3.1: Ignition tube containing solution of X, dipped in a conical flask containing solution of Y.

Reaction between Sodium Sulphate and Barium Chloride Solution

Selected Video

Play Pause Stop Full

The Home Scientist 020 - Isolating Bromine

Reaction of Zinc with Dilute Sulphuric Acid (Olabs:Amrita University)

Reaction between Sodium Sulphate and Barium Chloride Solution (Olabs:Amrita...) ✓

videos

Toward data-driven education (3).

Dispersion of Key Concepts in Section

Many unrelated concepts -> Hard to understand section

- V = set of key concepts discussed in section s
 - Terminological noun phrases: Linguistic pattern A^*N^+ (A: adjective; N: noun)
 - “concepti” Wikipedia titles
- $\text{Related}(x,y)$ = Concept x is related to concept y – Co-occurrence
 - true if Wikipedia article for x links to the article for y
- $\text{Dispersion}(s)$:= Fraction of unrelated concept pairs
 - $(1 - \text{Edge Density})$ of the concept graph

Toward data-driven education (4)

Avoid repetition across sections:

$$\max \sum_{i \in I} \sum_{j \in S} x_{ij} \cdot \lambda_{ij}$$

Relevance score of object i to section j

Total relevance score for the chapter: sum of relevance scores of objects assigned

s.t.

$$x_{ij} \in \{0, 1\} \quad \forall i \in I \forall j \in S$$

=1 if image i is selected for section j else 0

$$\sum_{i \in I} x_{ij} \leq K_j \quad \forall j \in S$$

Constraint: At most K_j images can be assigned to section j

$$\sum_{j \in S} x_{ij} \leq 1 \quad \forall i \in I$$

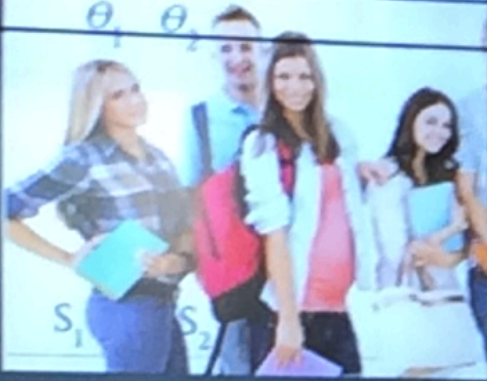


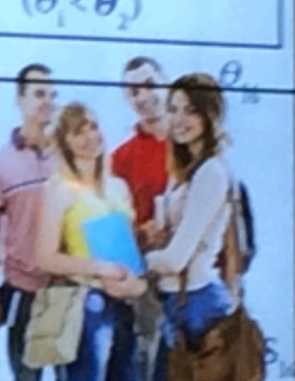
Constraint: An image can belong to at most one section

Can be solved optimally in polynomial time

Toward data-driven education (5).

Выделение подгрупп студентов

Model

Leaders ($\theta_i \geq \theta_1$)	Followers ($\theta_i < \theta_1$)	Leaders ($\theta_i \geq \theta_2$)	Followers ($\theta_i < \theta_2$)
θ_1 θ_2  S_1 S_2			 θ_{10} S_{10}

- ❖ Team ability Θ_T = Average of ability of members
- ❖ Gain for Team = Gain for Leaders L_T + Gain for Followers F_T
- ❖ For this talk, Gain(T) = $|F_T|$. That is, maximize the number of s who are able to increase their ability to the group level.
- ❖ Alternative: Maximize the increase in group ability

Toward data-driven education (4)

Hot off the Press [EDM June 2017]

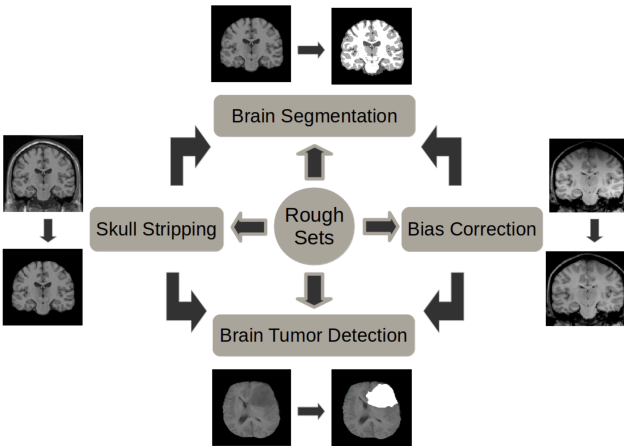
Every student can gain from peer interactions

$\text{Gain}_i = (\theta_{ip} - \theta_i)$, where θ_{ip} is the score of the student at p percentile among higher ability peers of i in the team

Maximizing total gain be solved optimally in $O(N \log N)$ time

Advances in Rough Set Based Hybrid Approaches for Medical Image Analysis

Pradipta Maji, Indian Statistical Institute



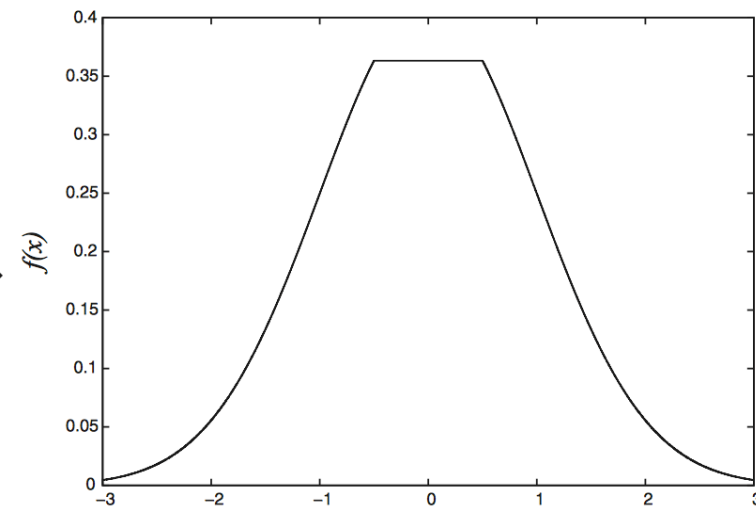
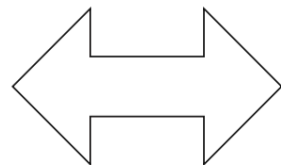
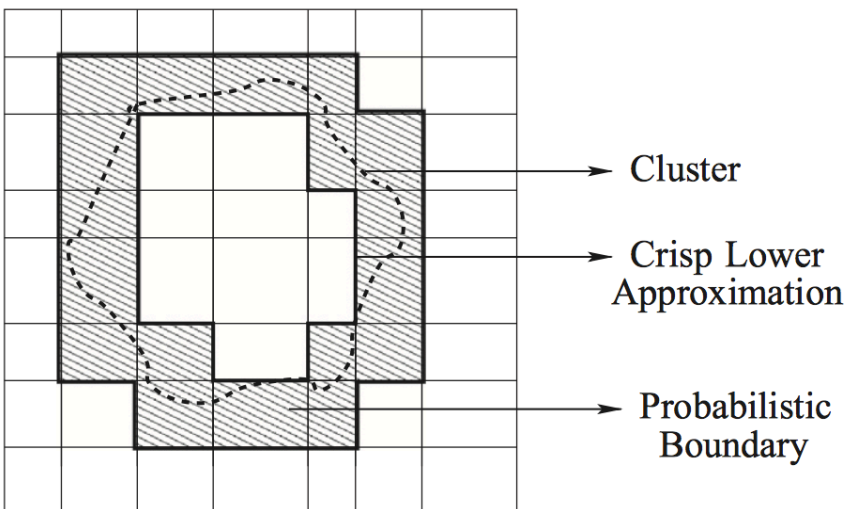
Stomped-t distribution: A. Banerjee, P. Maji/
Information Sciences 421 (2017) 104–125

$$f(y; \mu, \sigma^2, k) = \frac{1}{D} \frac{1}{\sigma} \phi(z), \quad y \in \mathbb{R}; \quad \text{where } z = \begin{cases} k, & \text{if } |\frac{y-\mu}{\sigma}| < k \\ \frac{y-\mu}{\sigma}, & \text{otherwise,} \end{cases}$$

$$D = 2(1 - \Phi(k) + k\phi(k)).$$

$\phi()$ and $\Phi()$ are, respectively, the pdf and probability distribution functions of standard normal distribution

Rough-probabilistic clustering



More with less: A new paradigm in modern Machine Learning

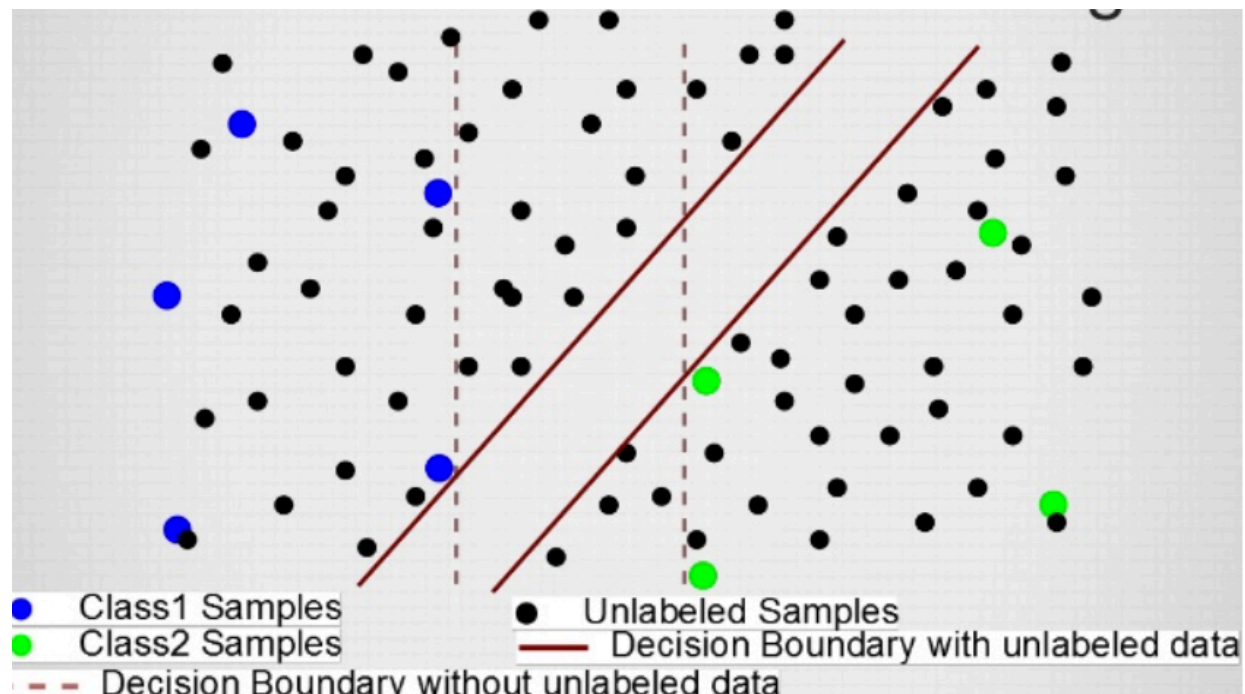
Nguyen Hung Son, University of Warsaw

Most of deep learning approaches:

- rely on the availability of huge amounts of data,
- often requiring millions of correctly labelled examples.

We will discuss the newest learning techniques for the case when we have

- a huge amount of data but
- very little amount of labelled data.



Big data analysis by rough sets and granular computing

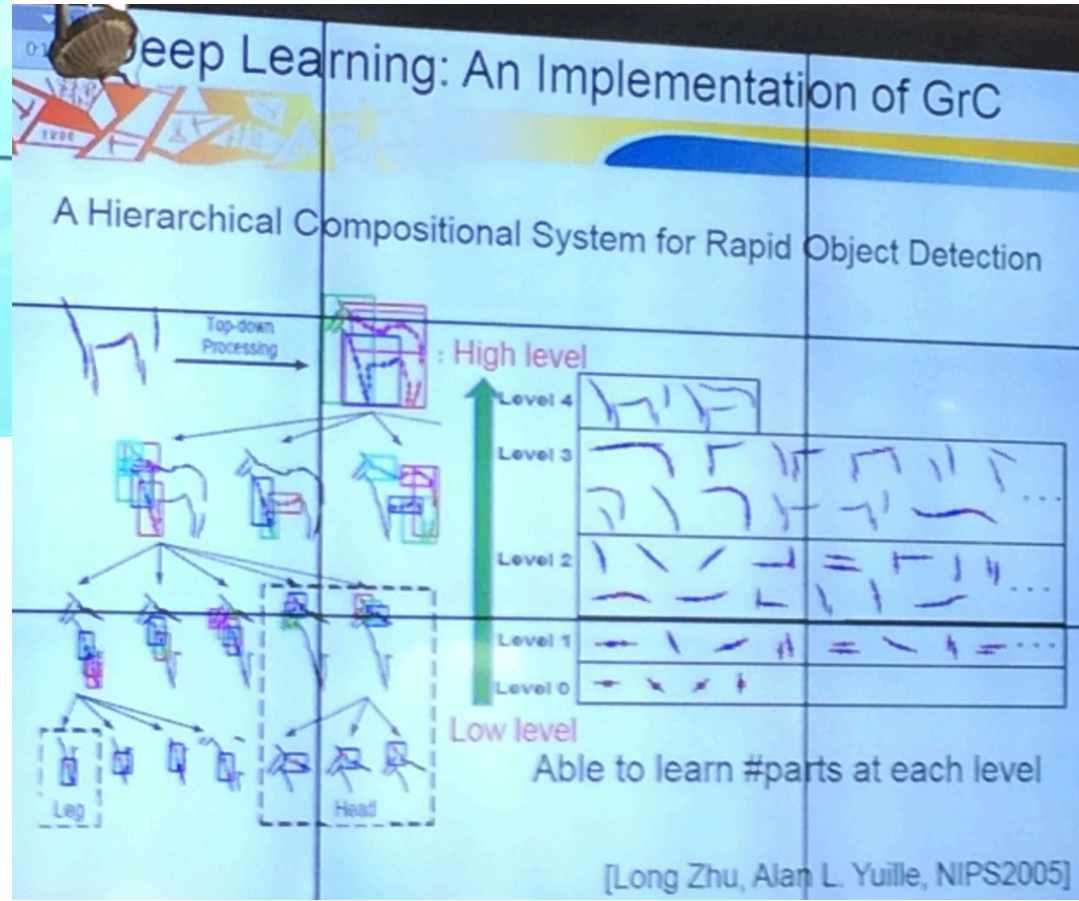
Tianrui Li

Global Precedence (GP): People always recognize the large characters in the global level at first and then the small characters in the local level.



Lin Chen, 1945~
Psychologists

H H H H H H H H	S S S S S S S S
H H H H H H H H	S S S S S S S S
H H H H H H H H	S S S S S S S S
H H H H H H H H	S S S S S S S S
H H H H H H H H	S S S S S S S S
H H H H H H H H	S S S S S S S S
H H H H H H H H	S S S S S S S S
H H H H H H H H	S S S S S S S S



Three-way decisions (TWD)

Yiyu Yao, University of Regina (Canada)

Yiyu Yao, *Three-way decisions with probabilistic rough sets, Information Sciences*

“Rules constructed from the three regions are associated with different actions and decisions, which immediately leads to the notion of three-way decision rules. A **positive** rule makes a **decision of acceptance**, a **negative** rule makes a **decision of rejection**, and a **boundary** rule makes a **decision of abstaining**”

