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

![Image](image-url)

image-level labels:

- Person
- Chair
- Airplane

Test output

![Image](image-url)

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, Chaftield et al.’14]
Action recognition

- playing instrument
- jumping
- using computer
- phoning
Weak supervision from scripts: Joint Learning of Actors and Actions

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

\[
\min_{Z,T,w,b,v,c} \frac{1}{N} \| Z - \phi(X)w - b \|_F^2 + \lambda_1 Tr(w^T w) + \frac{1}{N} \| T - \psi(X)v - c \|_F^2 + \lambda_2 Tr(v^T v)
\]

\[
\begin{bmatrix}
    z_{11} & \cdots & z_{1p} & \cdots & z_{1P} \\
    \vdots & & \vdots & & \vdots \\
    z_{n1} & \cdots & z_{n1p} & \cdots & z_{nP} \\
    z_{n21} & \cdots & z_{n2p} & \cdots & z_{nP} \\
    z_{n31} & \cdots & z_{n3p} & \cdots & z_{nP} \\
    \vdots & & \vdots & & \vdots \\
    z_{N1} & \cdots & z_{Np} & \cdots & z_{NP}
\end{bmatrix}

\begin{bmatrix}
    t_{11} & \cdots & t_{1a} & \cdots & t_{1A} \\
    \vdots & & \vdots & & \vdots \\
    t_{n1} & \cdots & t_{n1a} & \cdots & t_{n1A} \\
    t_{n2} & \cdots & t_{n2a} & \cdots & t_{n2A} \\
    t_{n3} & \cdots & t_{n3a} & \cdots & t_{n3A} \\
    \vdots & & \vdots & & \vdots \\
    t_{N1} & \cdots & t_{Na} & \cdots & t_{NA}
\end{bmatrix}
\]

Person p appears in clip N:
Action a appears in clip N:
Person p and Action a appear in clip N:

\[
\sum_{n \in N_i} z_{np} \geq 1
\]

\[
\sum_{n \in N_i} t_{na} \geq 1
\]

\[
\sum_{n \in N_i} z_{np} t_{na} \geq 1
\]

\(p = \text{Rick}\)

\(a = \text{Walk}\)
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

\[ h(Z) = \min_{W \in \mathbb{R}^{K \times d}} \frac{1}{2T} \left\| Z - XW \right\|_F^2 + \frac{\lambda}{2} \left\| W \right\|_F^2 \]

Discriminative loss on data

Regularizer

s.t. \( Z \in \mathcal{Z} \), ordered script

\( A[Z] \geq R \), weak textual constraints

\([\text{Bach and Harchaoui'08, Xu et al.'04, Bojanowski et al.'13,'14,'15}]\)
Large-scale video tagging

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

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

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)

Gödel Prize 2003

“Does my new algorithm still follow from each?”

<table>
<thead>
<tr>
<th>My new algorithm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional Gradient Descent</td>
</tr>
<tr>
<td>Decision Theory</td>
</tr>
<tr>
<td>Margin Theory</td>
</tr>
<tr>
<td>Probabilistic Modelling</td>
</tr>
</tbody>
</table>
All algorithms produce uncalibrated probability estimates!
Training: Reserve part of training data (here 50% - more on this later) to fit a sigmoid to correct the distortion:

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

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

Параметры $A, B$ определяются с помощью метода максимума правдоподобия
Recognizing Activities of Daily Living from Egocentric Images

Alejandro Cartas, Juan Marín, Petia Radeva, Mariella Dimiccoli
University of Barcelona

Egocentric (first-person) wearable cameras

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
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

- 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.

3.1: Atoms and Molecules: Laws of Chemical Combination

ATOMS AND MOLECULES

3.1.1 Law of Conservation of Mass

There is a change in mass when a chemical change (chemical reaction) takes place.

Activity 3.1
1. Take one of the following sets, X and Y of chemicals:
   - X: acetic acid, sodium carbonate
   - Y: copper sulphate, sodium carbonate
2. Prepare separately a 5% solution of any one pair of substances listed under X and Y in water.
3. Take a little amount of solution of X in a conical flask and some solution of Y in an ignition tube.
4. Hang the ignition tube in the flask carefully, see that the solutions do not get mixed.
5. Put a cork on the flask (see Fig. 3.12).

Selected Video

Reaction between Sodium Sulphate and Barium Chloride Solution (Olabc:Amrita University)

Reaction between Zinc with Dilute Sulphuric Acid (Olabc:Amrita University)
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

• Related\((x,y)\) = Concept \( x \) is related to concept \( y \) – Co-occurrence
  – true if Wikipedia article for \( x \) links to the article for \( y \)

• 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 \(j\)

s.t.

\[
x_{ij} \in \{0, 1\} \ \forall i \in I \forall j \in S
\]

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

\[
\sum_{i \in I} x_{ij} \leq K_j \ \forall j \in S
\]

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

\[
\sum_{j \in S} x_{ij} \leq 1 \ \forall i \in I
\]

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

- Team ability $\Theta_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 students who are able to increase their ability to the group level.
- Alternative: Maximize the increase in group ability
Hot off the Press [EDM June 2017]

Every student can gain from peer interactions

\[ \text{Gain}_i = (\theta_{ip} - \theta_i), \]  where \( \theta_{ip} \) 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

Work with Sharad Narayanwalla and Arijit Roy (c)
Advances in Rough Set Based Hybrid Approaches for Medical Image Analysis

Pradipta Maji, Indian Statistical Institute


\[
f(y; \mu, \sigma^2, k) = \frac{1}{D} \frac{1}{\sigma} \phi(z), \quad y \in \mathbb{R}; \\
D = 2(1 - \Phi(k) + k\phi(k)),
\]

\(\varphi()\) 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
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**.