

# Automatic Annotation Synchronizing with Textual Description for Visualization

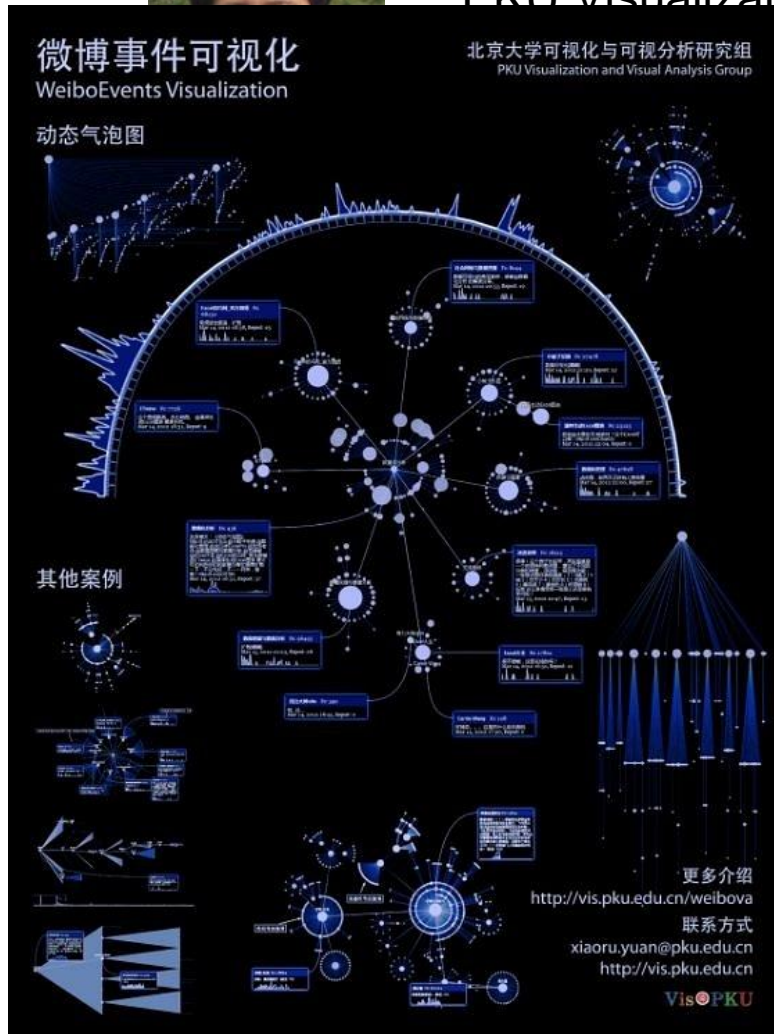
Chufan Lai, Zhixian Lin, Ruike Jiang, Yun Han, Can Liu, Xiaoru Yuan



# Xiaoru Yuan, Department of Intelligent Science and Technology, Peking University.

## PKU Visualization and Visual Analytics Group

Visualization, Computer Graphics, Interaction Design, High-dimensional data



疫情晴雨表



疫情晴雨表 (城市版)



疫情晴雨表 (世界版)



疫情晴雨表 (境外输入)



全国疫情态势



零增长地图



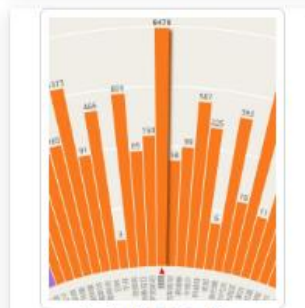
全国疫情态势



疫情方寸间



疫情方寸间 (国际版)



全球疫情态势图





**Ruike Jiang, Department of Intelligent Science and Technology, Peking University.**  
PKU Visualization and Visual Analytics Group.



**Yun Han, Department of Intelligent Science and Technology, Peking University.**  
PKU Visualization and Visual Analytics Group.

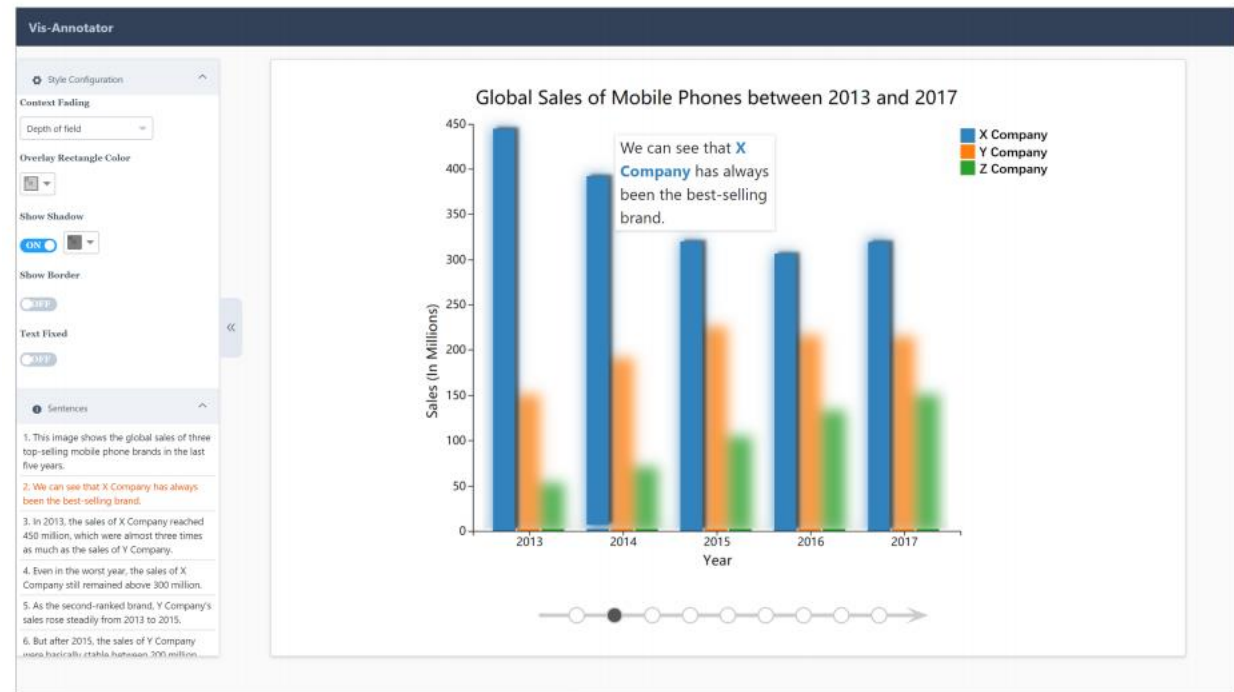


**Can Liu, Department of Intelligent Science and Technology, Peking University.**  
PKU Visualization and Visual Analytics Group.

# Vis-Annotator



(a) Upload



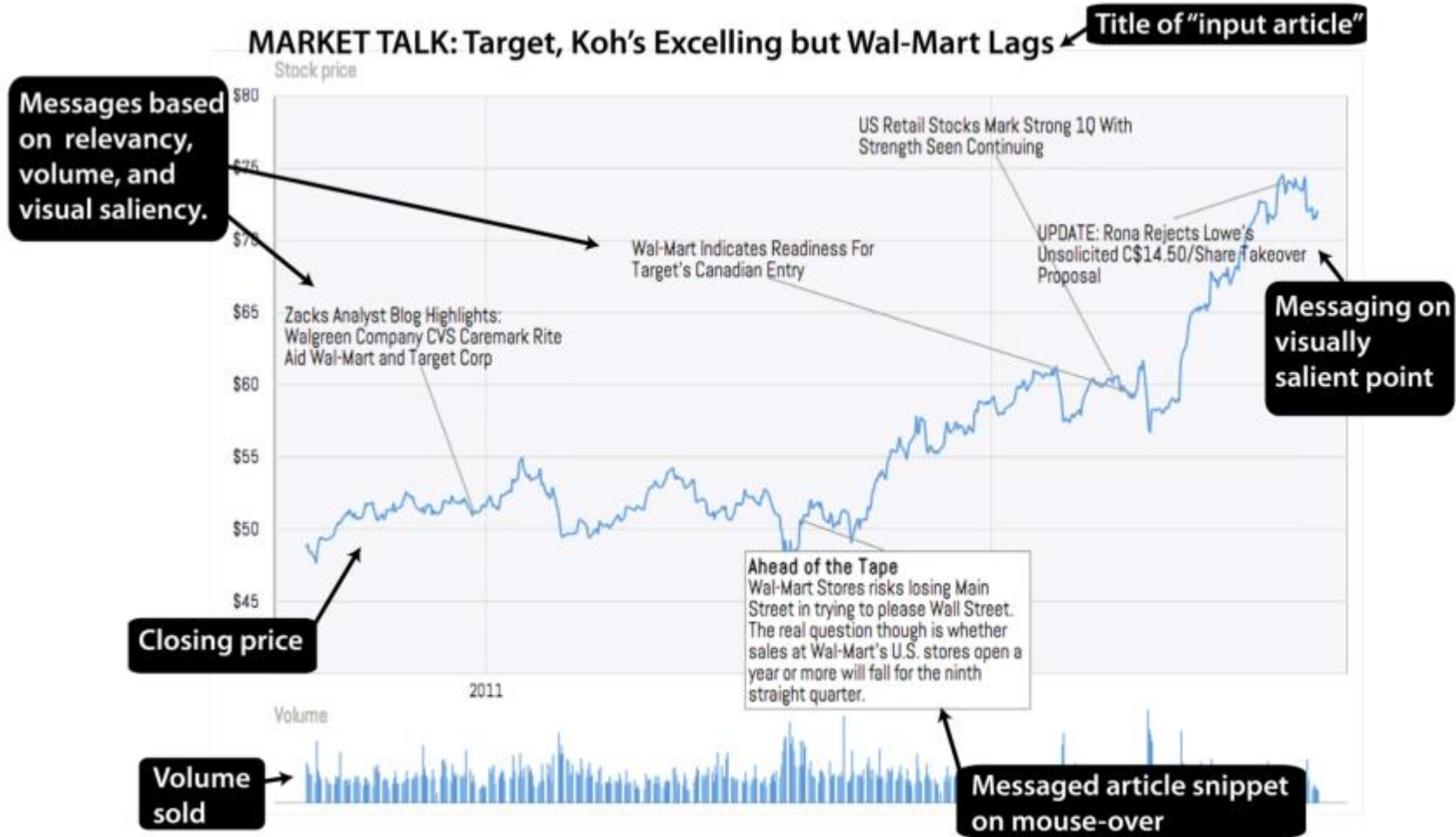
(b) Fine-Tune

# Motivation

- As the visualization becomes more complicated, it becomes boring and time-consuming for audiences to understand descriptions of a visualization.
- Due to limited short-term memory, the audiences must frequently switch between the description and the image.
- Automatic annotation can free the presenter's work.

# Related Work

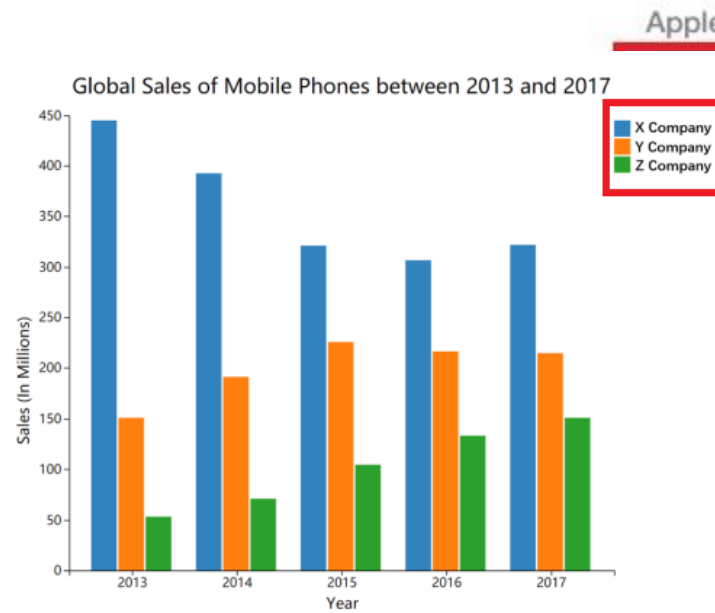
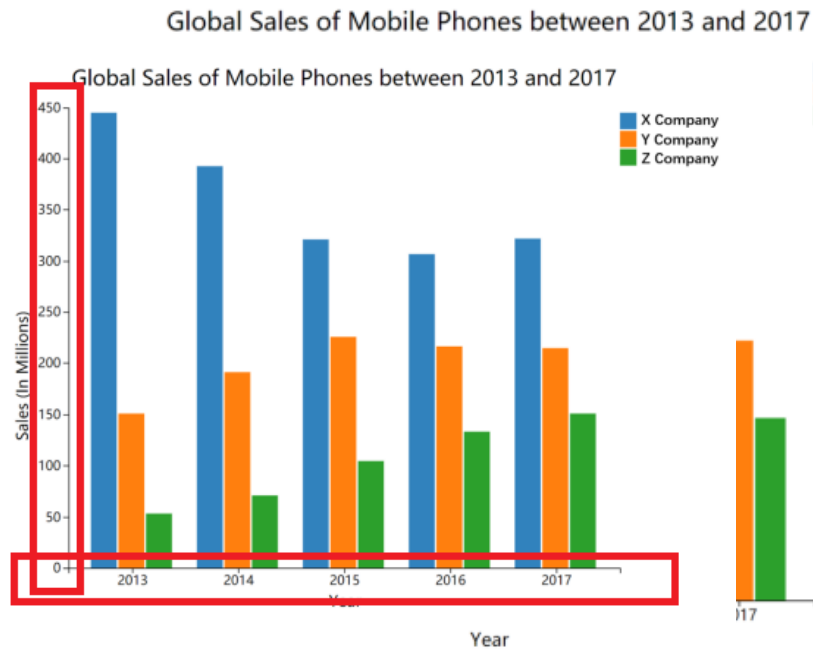
- An
- Au
- Ex
- Na
- Ge



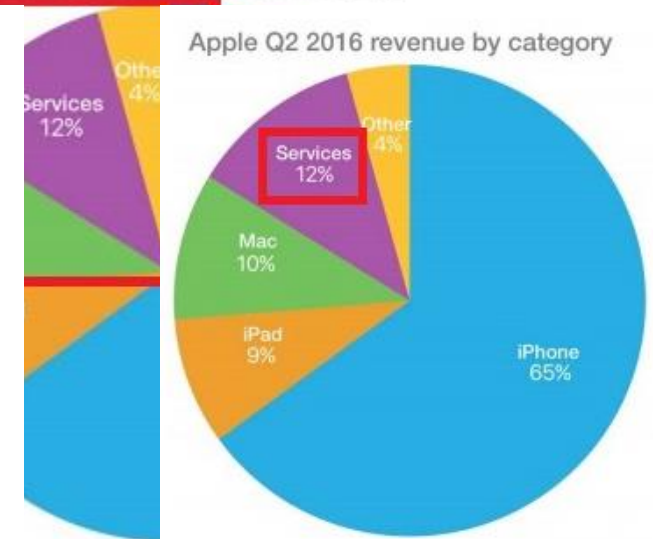
ation.

Data Entity: rectangles, circles, and sectors

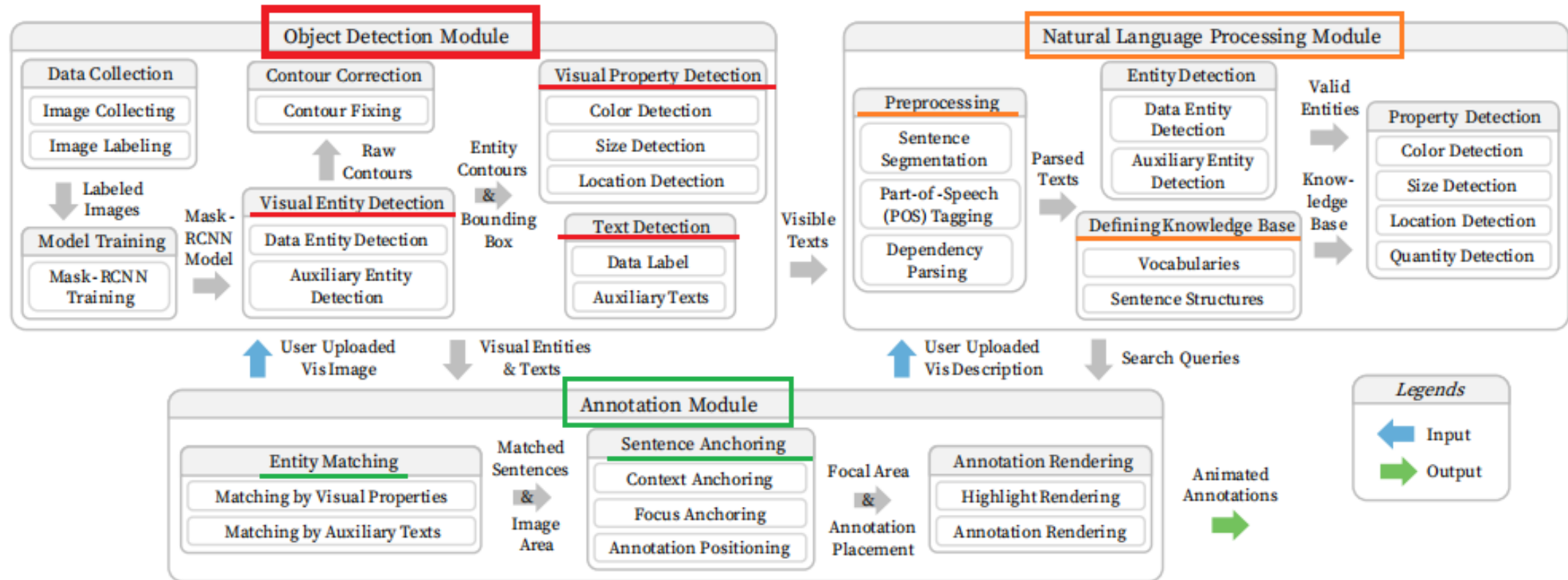
Auxiliary Entity: axes, legends, and data labels



Apple Q2 2016 revenue by category



# Three Major Modules





# Object Detection Module(OD)

- Visual Entity Detection



物体检测  
Object Detection



实例分割  
Instance Segmentation



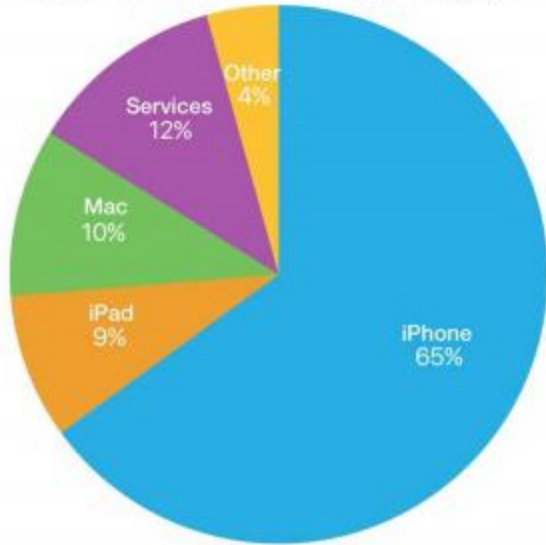
关键点检测  
Keypoint Detection

Mask R-CNN

# Object Detection Module(OD)

- Visual Entity Detection

Apple Q2 2016 revenue by category



Corpus Collecting

Apple Q2 2016 revenue by category

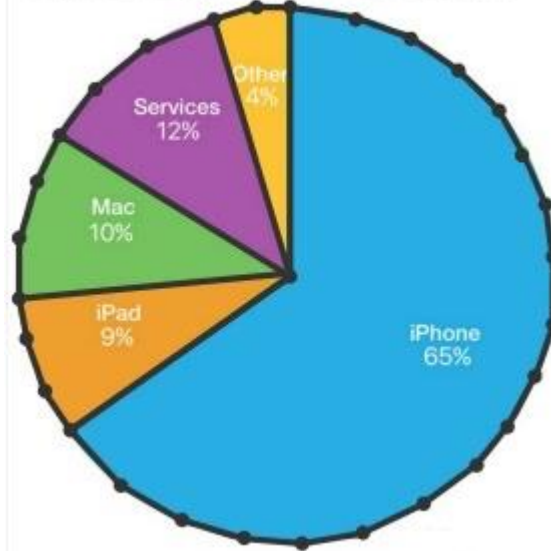
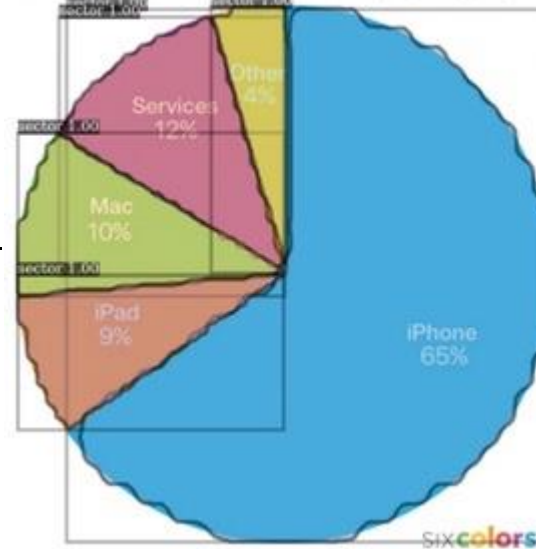


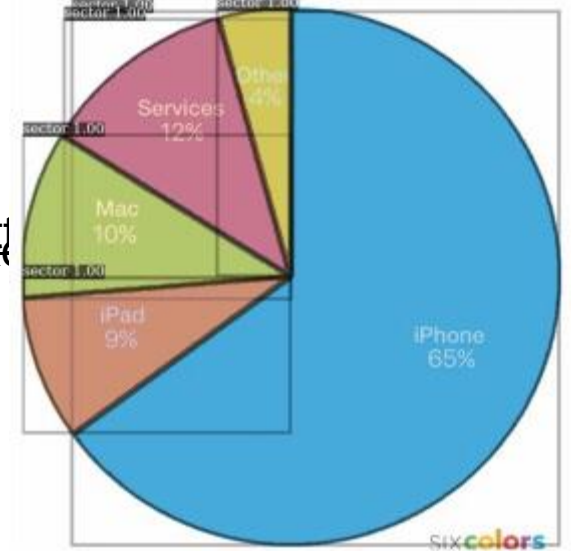
Image Labeling

Apple Q2 2016 revenue by category



Model Training

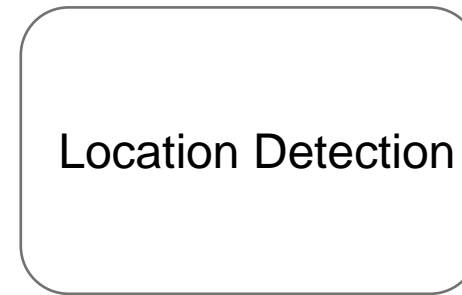
Apple Q2 2016 revenue by category



Contour Correction

# Object Detection Module(OD)

- Visual Property Detection



HSV color space —> 11 colors( • • • area, X-range, and Y-range

the position of centroid

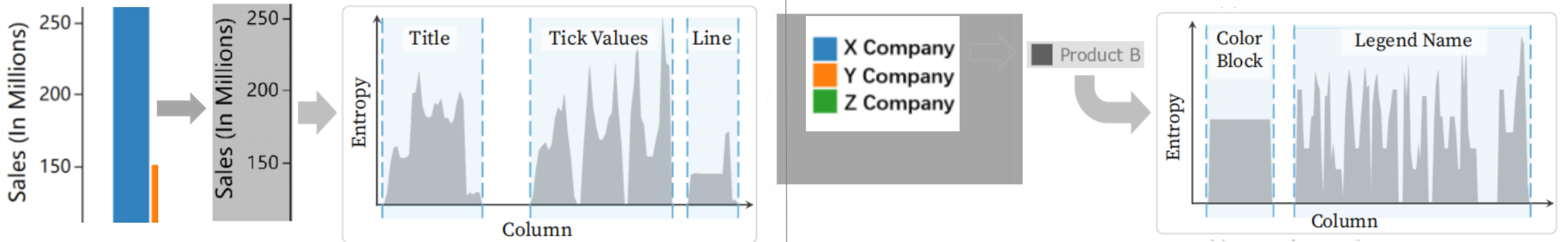
# Object Detection Module(OD)

- Text Detection(Tesseract-OCR)

Data Labels

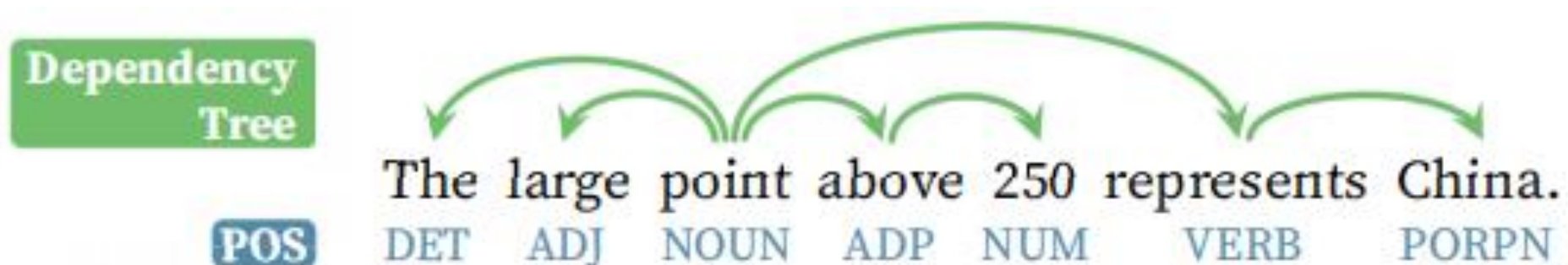
Axes

Legends



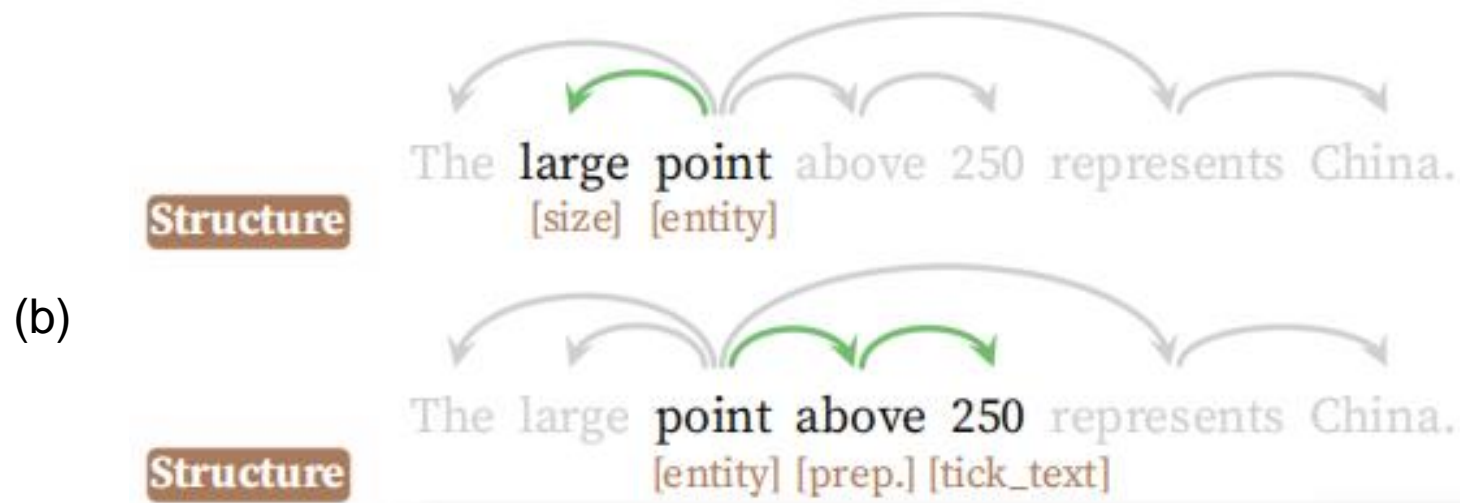
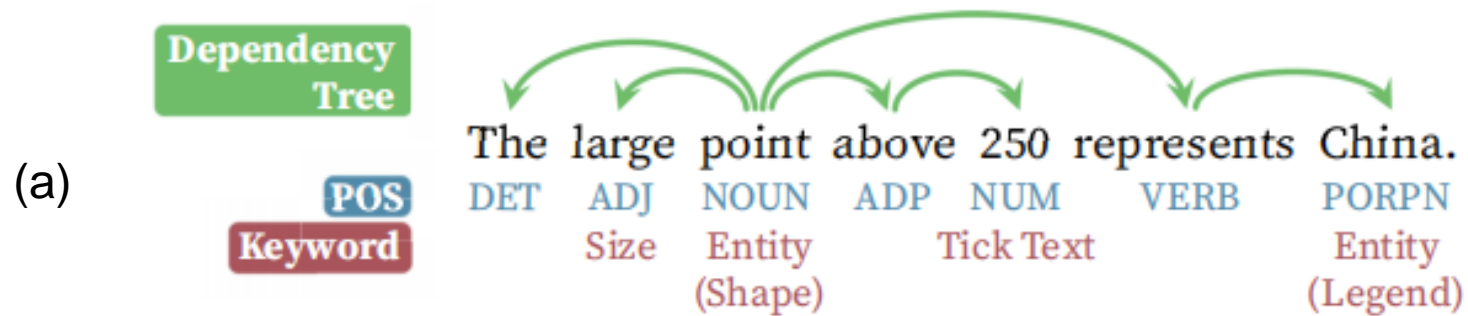
# Natural Language Processing Module(NLP)

- Processing(SpaCy)



# Natural Language Processing Module(NLP)

- Defining Knowledge Base  
standard vocabulary, synonyms vocabulary, structure library



"the red point"  
"the point in red"

# Natural Language Processing Module(NLP)

- Entity Detection

The large point above 250 represents China.



Queries

```
{name: "point", shape: "circle", size: "large",  
axis: {title: "score", tick: "250", relation: "above"}}
```

```
{name: "China", type: "legend"}
```

# Natural Language Processing Module(NLP)

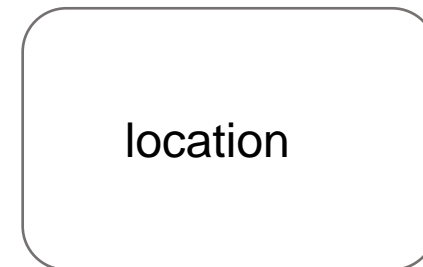
- Property Detection



“red”, “orange”, “brown”, “yellow”....



“large”, “small”, “long”....



“middle”, “top”, “bottom”....

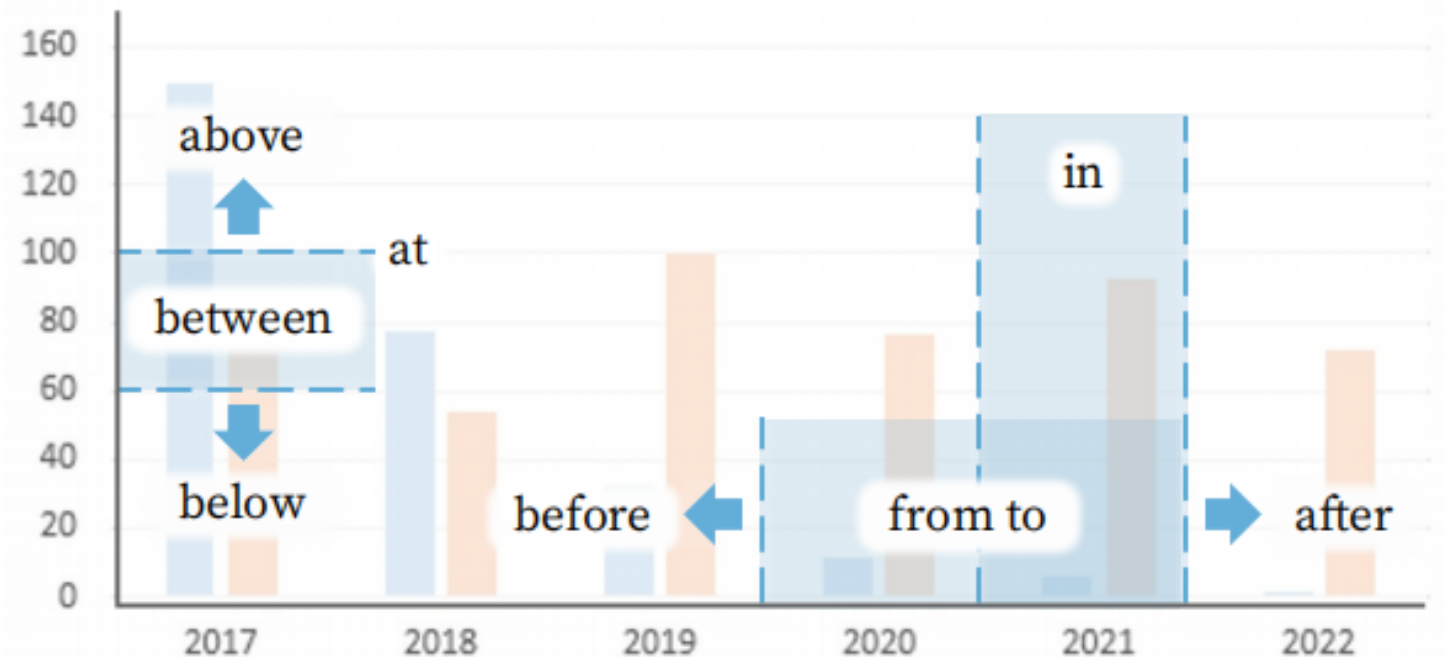


# Annotation

- Entity Matching( shape, a data label, or a legend name(NLP) )

Matching by Visual Properties  
(Color / Size / Location Matching)

Matching by Auxiliary Texts  
(Data labels / Legend / Axis Matching)



"below 2014" (numerical) vs. "before 2014" (ordinal)

# Annotation

- Sentence Anchoring (collision detection)
- Annotation Rendering

Style Configuration

Context Finding

Depth of field

Overlay Rectangle Color

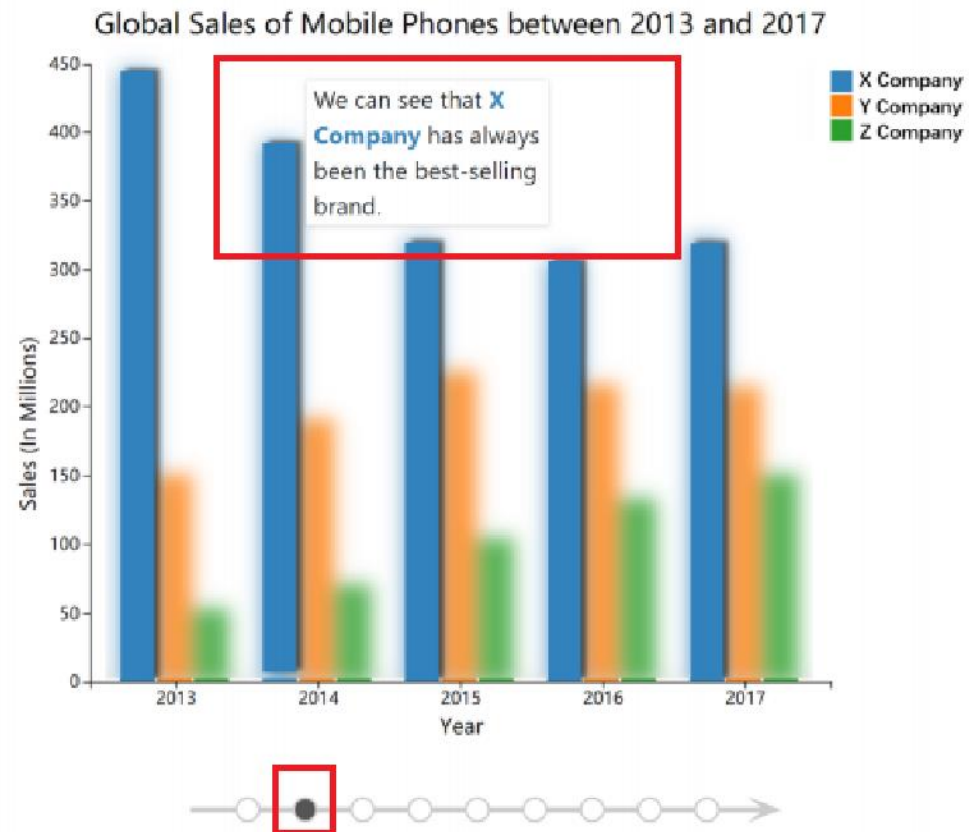
Show Shadow

Show Border

Text Fixed

Sentences

1. This image shows the global sales of three top-selling mobile phone brands in the last five years.
2. We can see that X Company has always been the best-selling brand.
3. In 2013, the sales of X Company reached 450 million, which were almost three times as much as the sales of Y Company.
4. Even in the worst year, the sales of X Company still remained above 300 million.
5. As the second-ranked brand, Y Company's sales rose steadily from 2013 to 2015.
6. But after 2015, the sales of Y Company were basically stable between 200 million

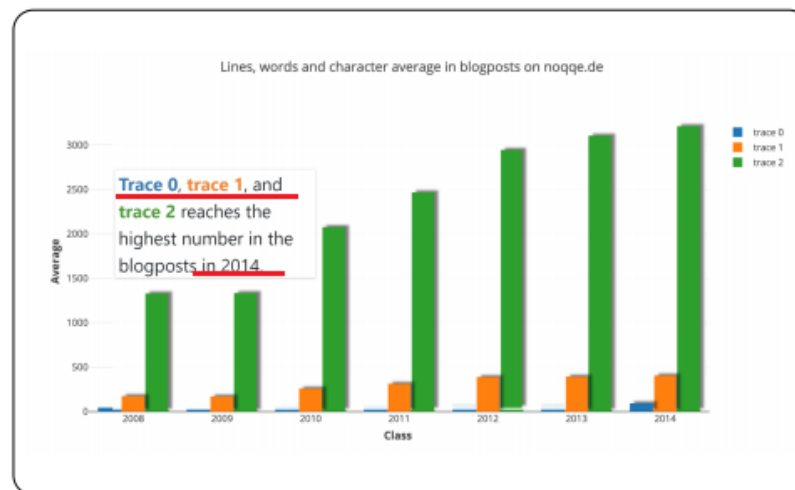


# Evaluation

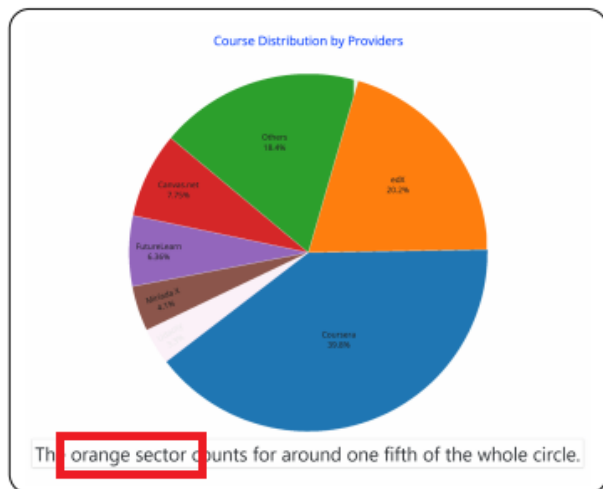
• C  
• C  
• N  
(1)  
(2)



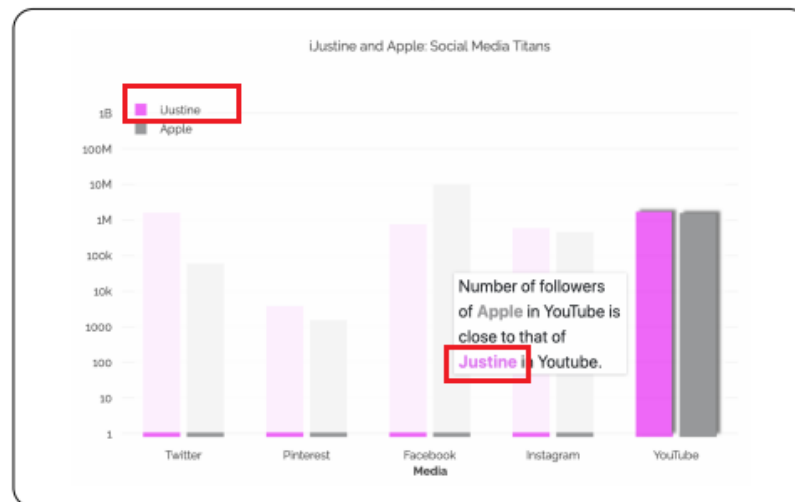
(a)



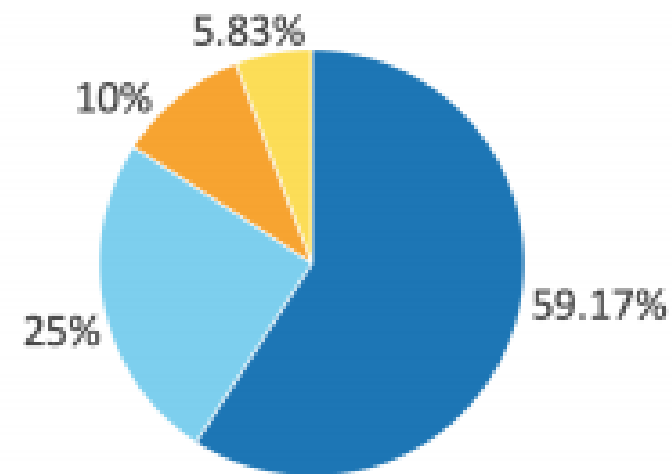
(c)



(b)



(d)



Correct    NLP-Error  
OCR-Error    OD-Error

# Pros

1. Automatic annotation is a new research perspective and cut-in point.
2. There is not much knowledge in other fields.
3. Point out the reason of automatic annotation error.

# Cons

Automatic annotation has limitations in more complex visualizations.

Thanks!