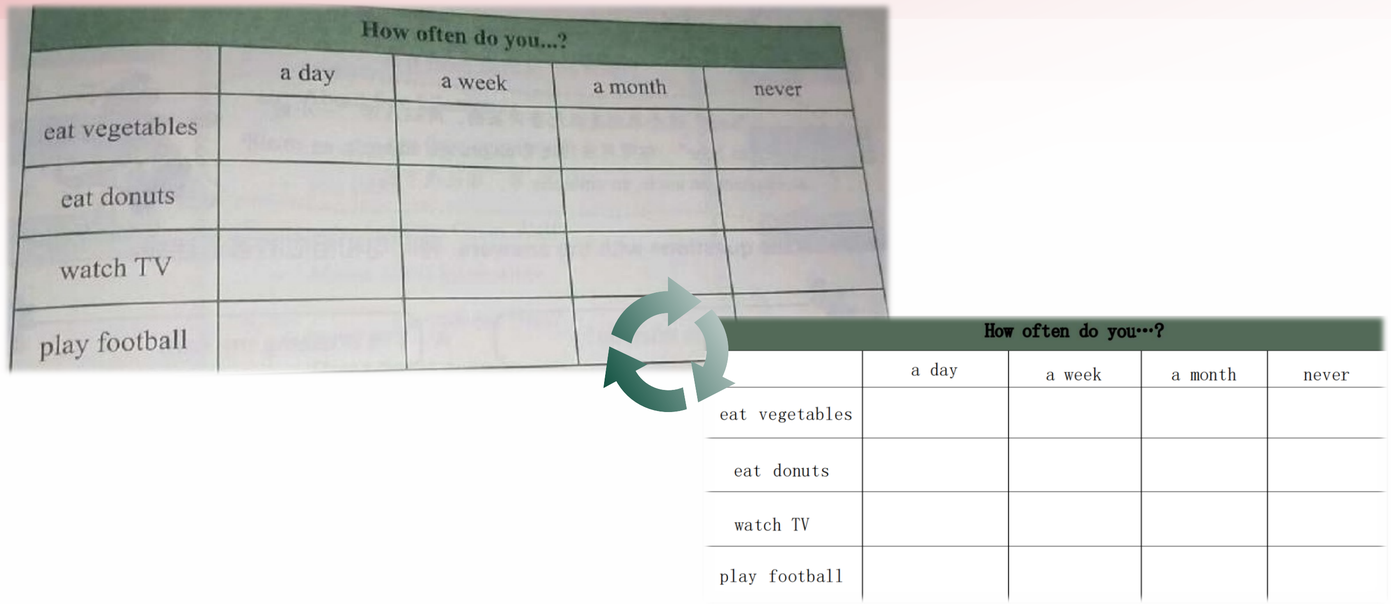
金山办公 KINGSOFT OFFICE | a Kingsoft Office PDF team



working together!

PDF Days Europe 2022 | Berlin

Deformed Table Restoration in Scanned PDF

Best practice:
Better table reconstruction results for scanned PDFs or Pictures under complex scenes.

Reporter : Xiong Longfei

working together!

Contents

01 Background and Challenges

working together!

The following are two most commonly used tables in PDFs

1

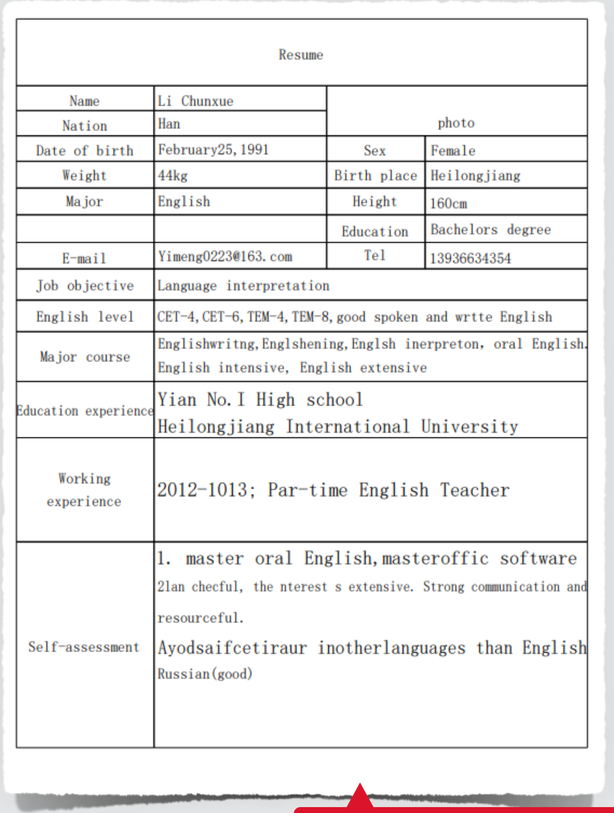
In standard PDF, the table lines, text, and image objects contained in it have known coordinates、Unicode, and even the type. It's relatively simple to restore it to a table with the original information.

Table example

Hallo	Hello	Hi	你好	Bonjour
Guten Tag	Привет	Hola	Ciao	Moin
早上好	こんにちは	Bonjour	Hallo	Tag
Hello	안녕하세요	你好	Hi	Hola

2

The regular table in the scanned PDF seems easy to process and its information can be obtained easily by ordinary image processing techniques. We can obtain near-perfect recognition results through open-source OCR.



Resume

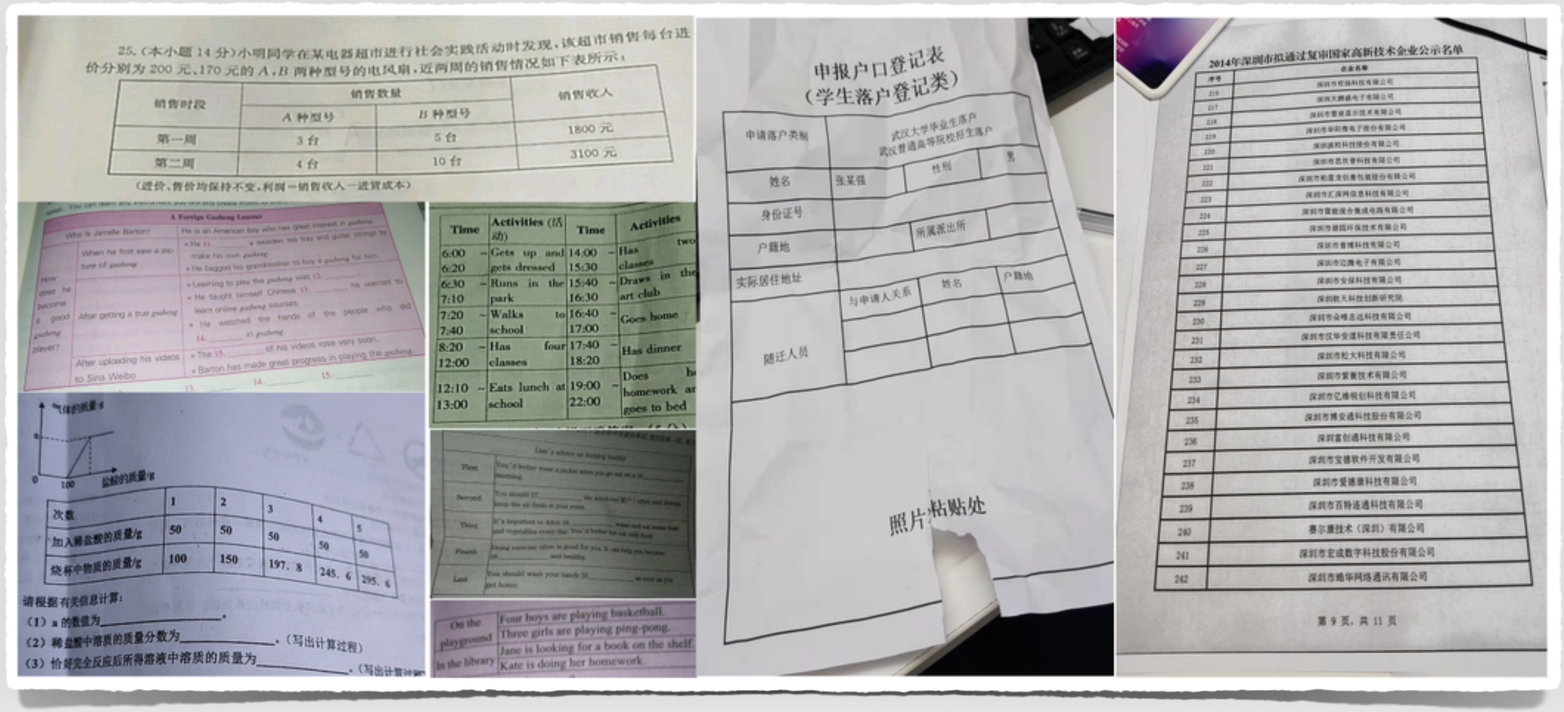
Name	Li Chunxue	photo	
Nation	Han		
Date of birth	February25, 1991	Sex	Female
Weight	44kg	Birth place	Heilongjiang
Major	English	Height	160cm
		Education	Bachelors degree
E-mail	Yimeng0223@163.com	Tel	13936634354
Job objective	Language interpretation		
English level	CET-4, CET-6, TEM-4, TEM-8, good spoken and wrtte English		
Major course	Englishwritng, Englshening, Englsh inerpreton, oral English, English intensive, English extensive		
Education experience	Yian No. I High school Heilongjiang International University		
Working experience	2012-1013; Par-time English Teacher		
Self-assessment	1. master oral English, masteroffic software 2lan checful, the nterest s extensive. Strong communication and resourceful. Ayodsaifcetiraur inotherlanguages than English Russian(good)		

It's a scaned PDF

01 Background and Challenges

working together!

The tables in the PDFs or photos, which are generated by old scanners or are taken by cell phones, might be skewed, blurred, deformed, or interfered by stamps and watermarks, and some texts might also be underlined, bolded, or color-changed. Therefore, it's incredibly challenging to reconstruct such complex tables from pixel information.



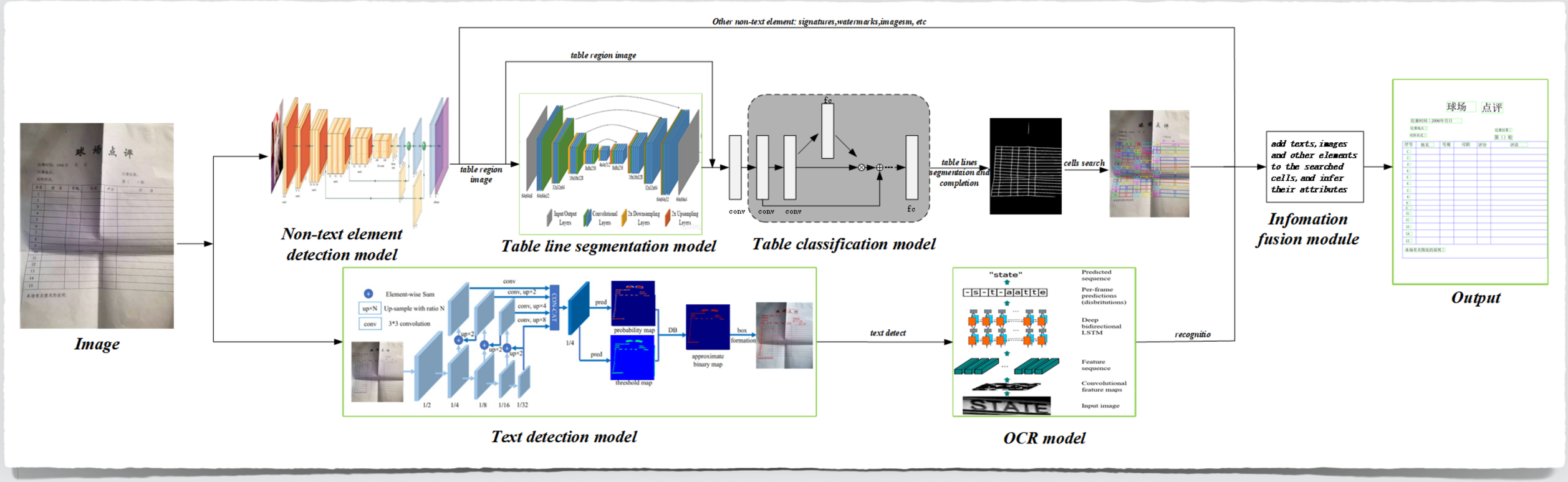
01 Background and Challenges

The problems we need to solve:

1. Layout analysis （line, text, image, seal, signature etc.）
2. Distorted table lines, crooked text, misaligned cells
3. Recognition and restoration of table structure
    - Get the table line
    - Remove the interference （redundant line and noise）
    - Supplement line
    - Confirm cells
4. Assemble all the parts
5. Refine text(color, size, font, bold, paragraph) and image

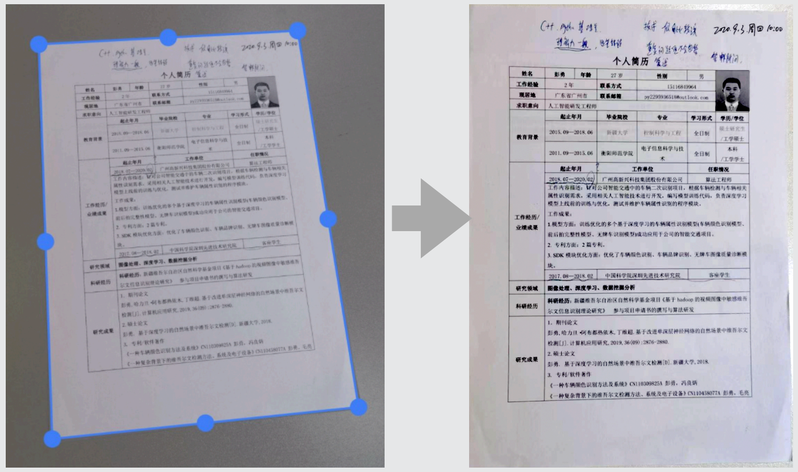
02 Route map

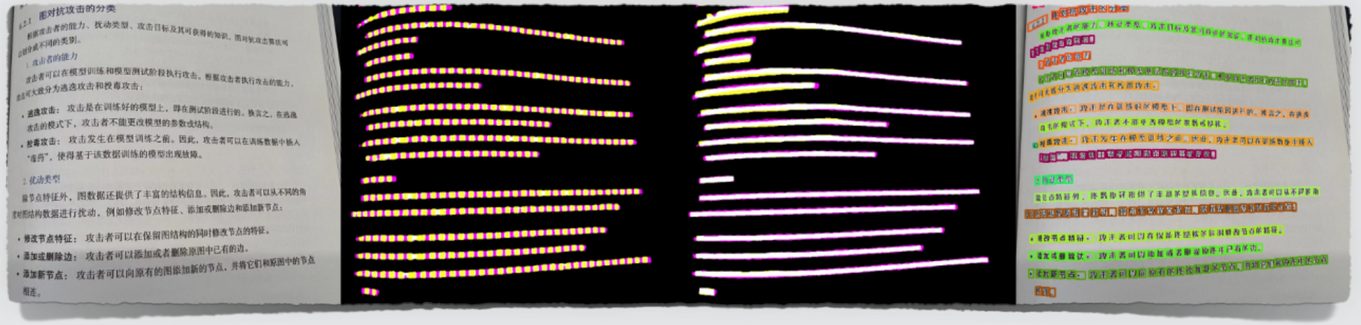
working together!

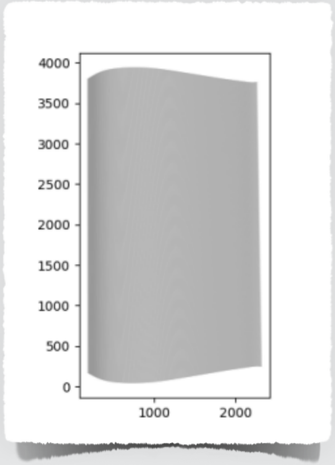


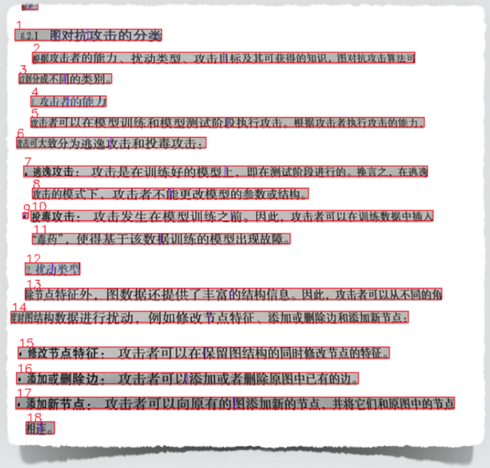
03 Layout correction

- Document perspective correction
- Document bending correction









62.1图对抗攻击的分类

根据攻击者的能力、扰动类型、攻击目标及其可获得的知识，图对抗攻击算法可则分成不同的类别

1攻击者的能力

攻击者可以在模型训练和模型测试阶段执行攻击。根据攻击者执行攻击的能力，攻击可大致分为逃逸攻击和投毒攻击：

，逃逸攻击： 攻击是在训练好的模型上，即在测试阶段进行的。换言之，在逃逸攻击的模式下，攻击者不能更改模型的参数或结构。

投毒攻击： 攻击发生在模型训练之前。因此，攻击者可以在训练数据中插入“毒药”，使得基于该数据训练的模型出现故障。

2.扰动类型

除节点特征外，图数据还提供了丰富的结构信息。因此，攻击者可以从不同的角度对图结构数据进行扰动，例如修改节点特征、添加或删除边和添加新节点：

- 修改节点特征： 攻击者可以在保留图结构的同时修改节点的特征
- 添加或删除边： 攻击者可以添加或者删除原图中已有的边。
- 添加新节点： 攻击者可以向原有的图添加新的节点，并将它们和原图中的节点相连。

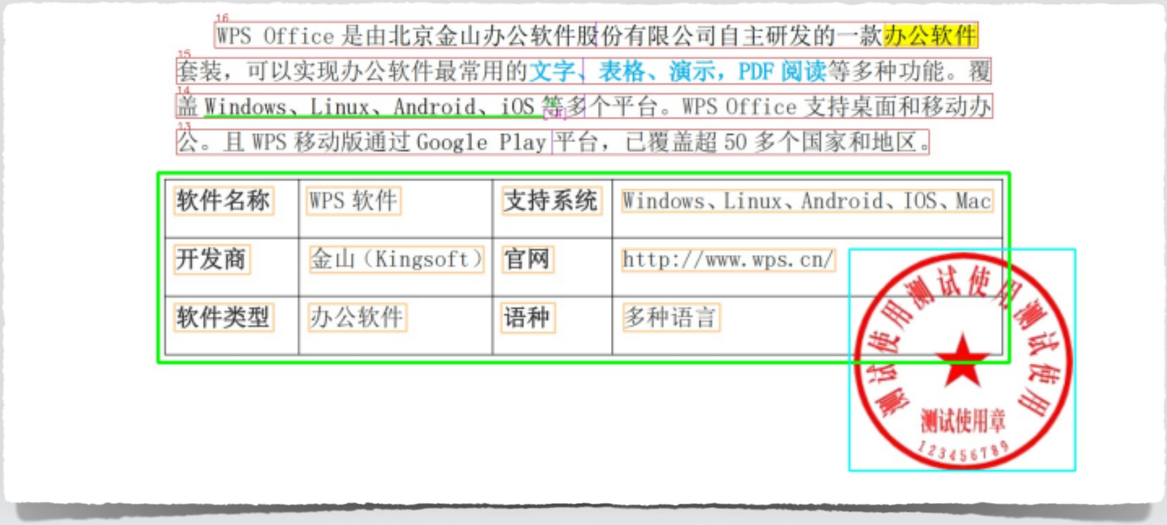
03 Layout analysis

working together!

Table, text, underline, image, seal, signature and all elements can be detected by well designed detection model (In our case, text and other objects are detected separately through two models).

WPS Office 是由北京金山办公软件股份有限公司自主研发的一款办公软件套装，可以实现办公软件最常用的文字、表格、演示，PDF 阅读等多种功能。覆盖 Windows、Linux、Android、iOS 等多个平台。WPS Office 支持桌面和移动办公。且 WPS 移动版通过 Google Play 平台，已覆盖超 50 多个国家和地区。

软件名称	WPS 软件	支持系统	Windows、Linux、Android、IOS、Mac
开发商	金山（Kingsoft）	官网	http://www.wps.cn/
软件类型	办公软件	语种	多种语言



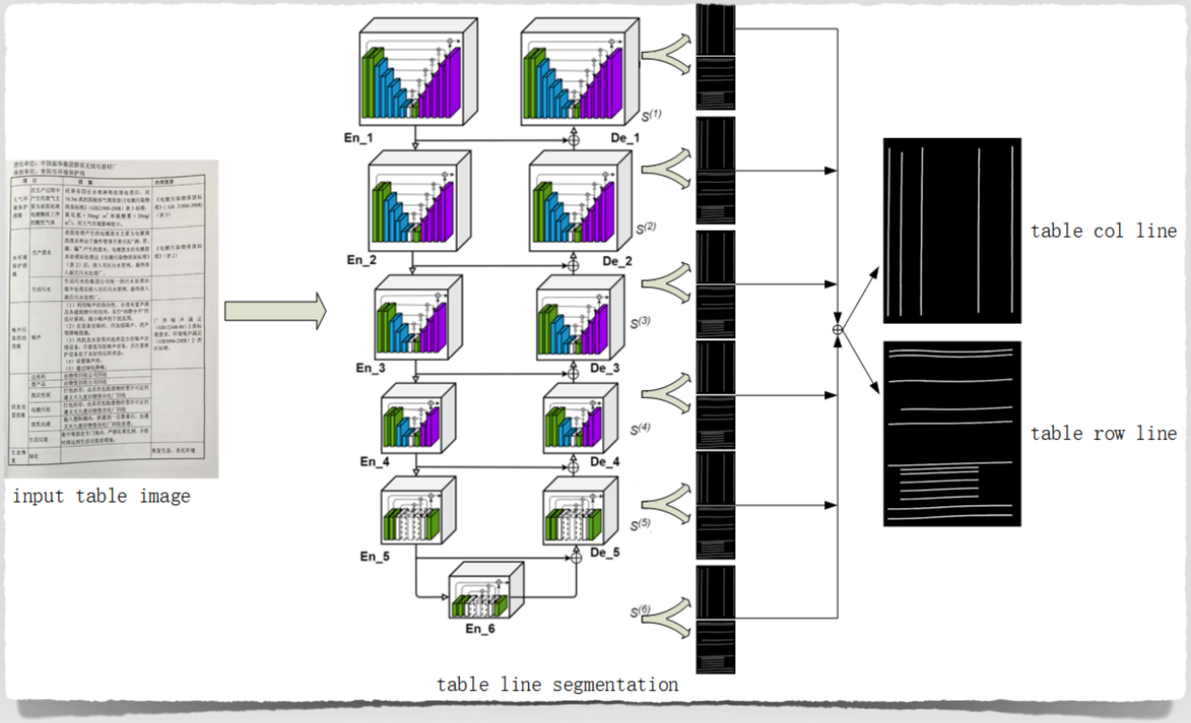
WPS Office 是由北京金山办公软件股份有限公司自主研发的一款办公软件套装，可以实现办公软件最常用的文字、表格、演示，PDF 阅读等多种功能。覆盖 Windows、Linux、Android、iOS 等多个平台。WPS Office 支持桌面和移动办公。且 WPS 移动版通过 Google Play 平台，已覆盖超 50 多个国家和地区。

软件名称	WPS 软件	支持系统	Windows、Linux、Android、IOS、Mac
开发商	金山（Kingsoft）	官网	http://www.wps.cn/
软件类型	办公软件	语种	多种语言

测试使用章
123456789

03 Obtaining table structure

The traditional table line extraction algorithm is only useful in oversimplified cases, such as tables with straight lines and plain backgrounds. However, the real cases would always be complicated. To solve such a dilemma, we adopt the saliency segmentation model U2Net to extract both vertical and horizontal table lines respectively. The structure diagram of the table segmentation model is as follows:



Model Tricks：

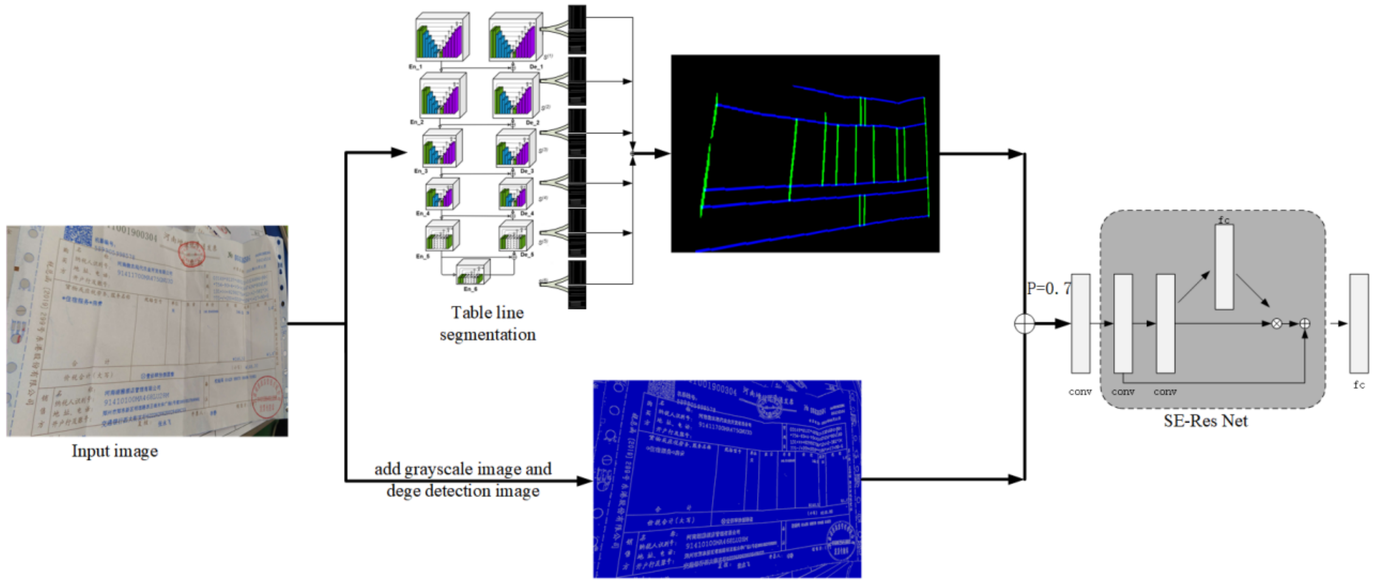
- Data enhancements
  - Adding background noise
  - Adding interference lines
  - Rotating, affine, bending image etc.
  - Changing tones or colors
- vertical and horizontal table lines dealt separately
- bce-loss & dice-loss joint optimization

03 Obtaining table structure

We divide tables into full-line tables (normal tables), less-line tables (tables with only horizontal lines or only vertical lines), and wireless tables. Then we use divergent restoration algorithms and strategies to obtain better restoration effects from these types of tables. For instance, we adopts SE-ResNet as the classification model. The input to the model is a proportional fusion of the table-line segmentation result, the grayscale image and the edge detection map.

xxx	xxx	xxx
xxx	xxx	xxx
xxx	xxx	xxx

xxx	xxx	xxx	xxx	xxx	xxx
xxx	xxx	xxx	xxx	xxx	xxx
xxx	xxx	xxx	xxx	xxx	xxx

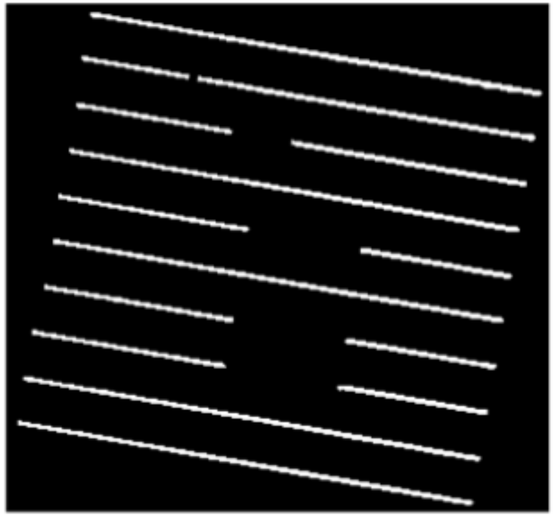


03 Obtaining table structure

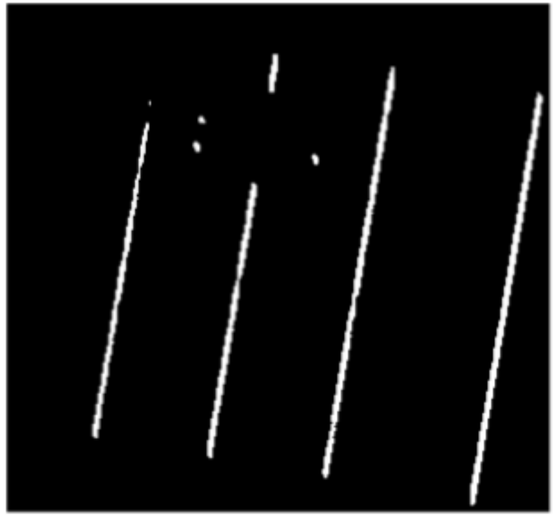
After dividing the row and column lines of the table, it is easy to find that the intersection of the row and column grid lines is the potential cell vertex. As shown in the figure below, endpoints that are a certain distance away from the table intersection could also be potential cell vertex.

K	L_d^0	L_s^{RS}	L_s^{IRSB}
3	–	8	7
4	17	21	20
5	40	54	53
6	91	131	130
7	200	309	307
8	428	708	705
9	905	1594	1592
10	1894	3546	3543

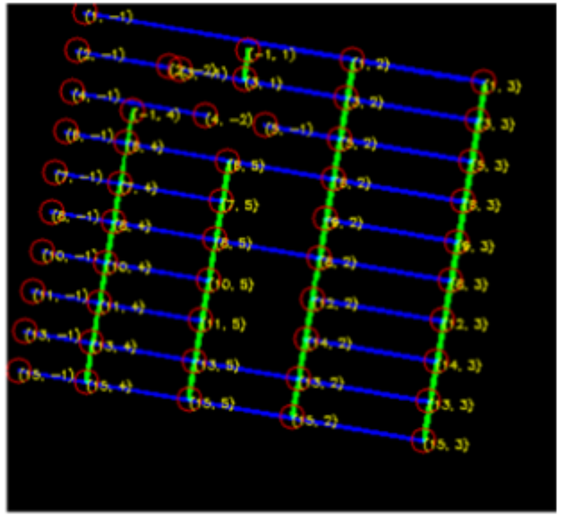
original image



row line



col line

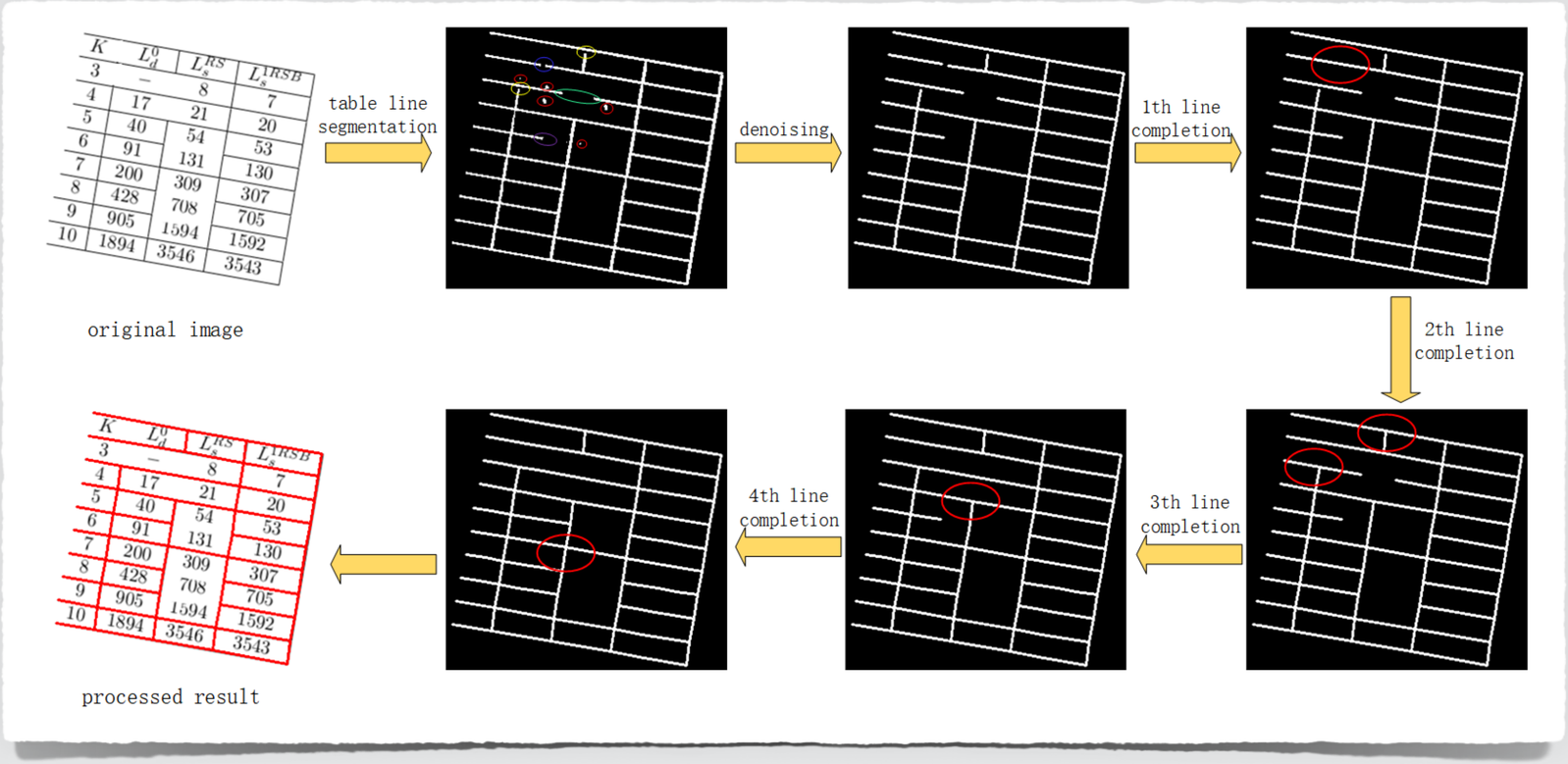


all potential cell vertices

03 Obtaining table structure

In complex situations like photographing, the segmentation results might have several defects, such as noises and broken lines. Hence, to get a more accurate table structure, it is recommended to do a post-processing base on the segmentation results.

First of all, de-noising the segmentation results. Then, completing the table lines through an iterative algorithm.



03 Obtaining table structure

working together!

After getting all the potential cell vertices, we model an undirected graph with all potential vertices. Each vertex contains the information of neighbor vertices that may exist in four directions of V-current: As shown in figure 3 below: V-left, V-right, None, V-down.

Then we apply these logical rules to all the cells and finally extract the structure of the table, as shown in figure 4 below.The flowchart demonstrates one of our traversing strategies.

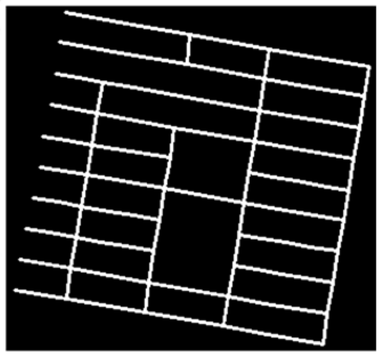
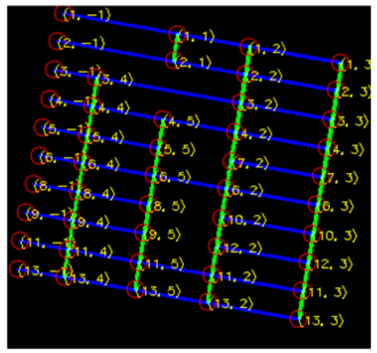
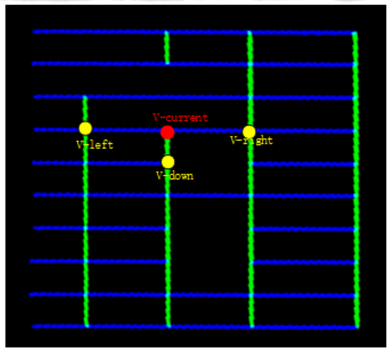


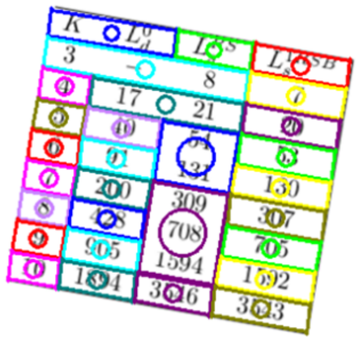
table line



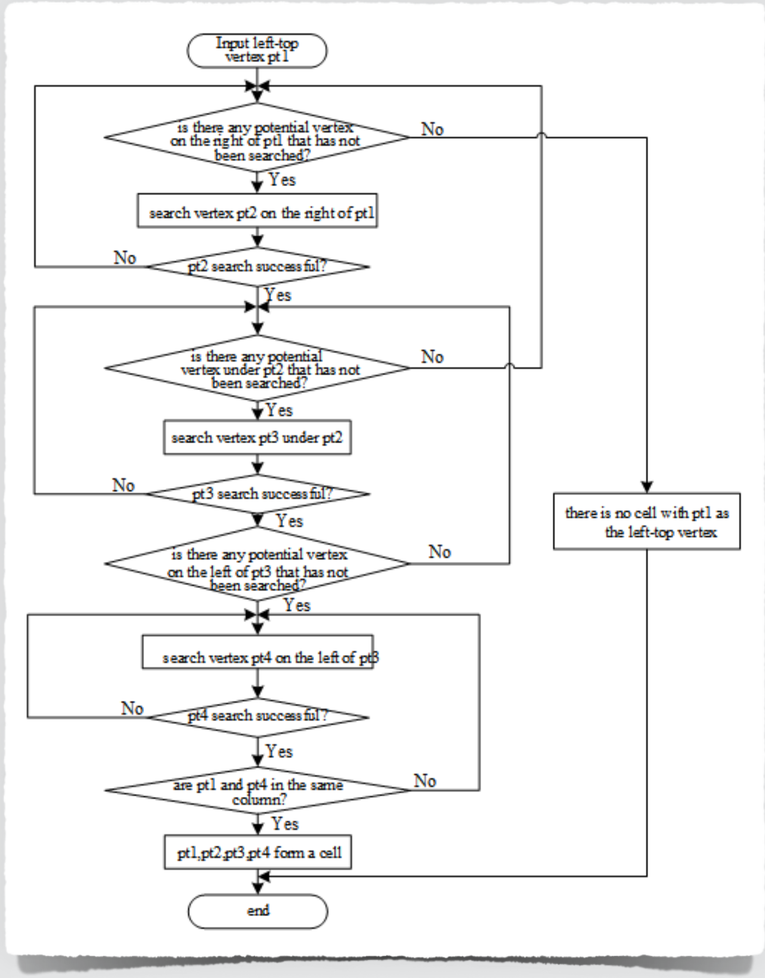
cell vertices



cell vertex graph



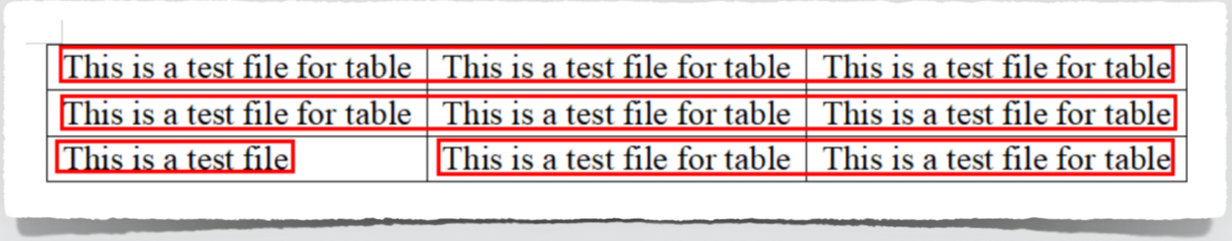
reconstruct results



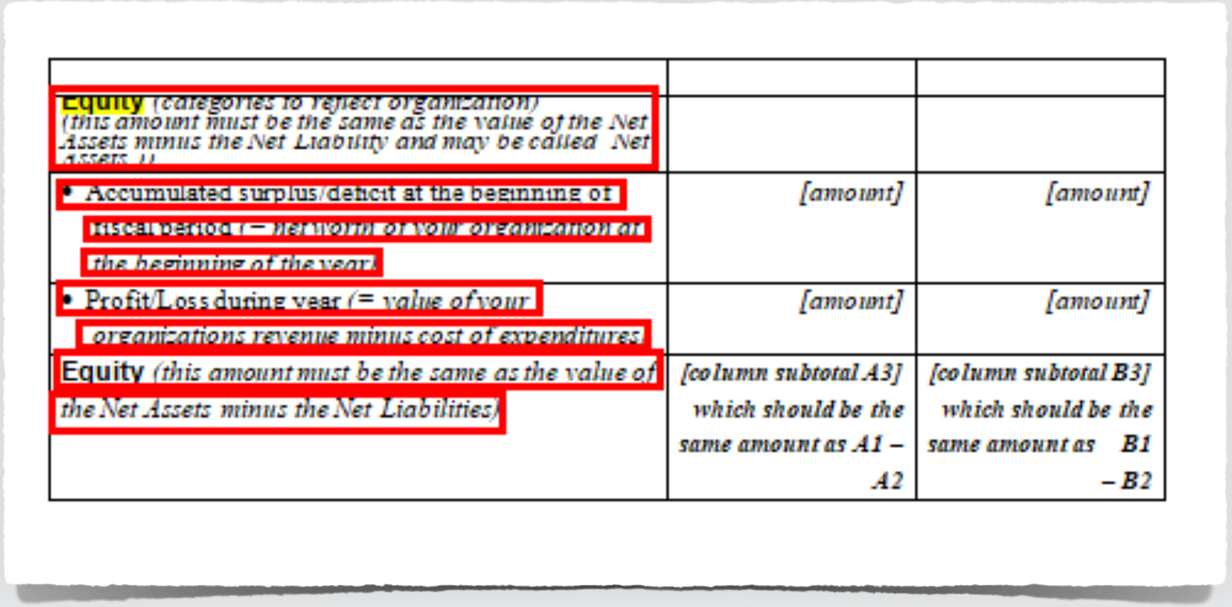
04 Text detection scheme for table restoration

working together!

In complex table scenarios, text detection and recognition tasks would be more difficult because of the effect of arbitrary-shaped text, dense text, table line interference, horizontal and vertical text ambiguity, etc.



This is a test file for table	This is a test file for table	This is a test file for table
This is a test file for table	This is a test file for table	This is a test file for table
This is a test file	This is a test file for table	This is a test file for table



Equity *(categories to reflect organization) (this amount must be the same as the value of the Net Assets minus the Net Liability and may be called Net assets.)*		
• Accumulated surplus/deficit at the beginning of fiscal period *(= net worth of your organization at the beginning of the year)*	*[amount]*	*[amount]*
• Profit/Loss during year *(= value of your organizations revenue minus cost of expenditures)*	*[amount]*	*[amount]*
Equity *(this amount must be the same as the value of the Net Assets minus the Net Liabilities)*	*[column subtotal A3] which should be the same amount as A1 – A2*	*[column subtotal B3] which should be the same amount as B1 – B2*

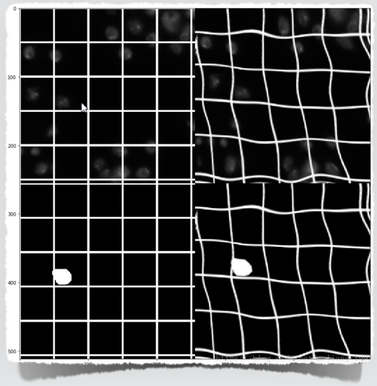
Bad cases：

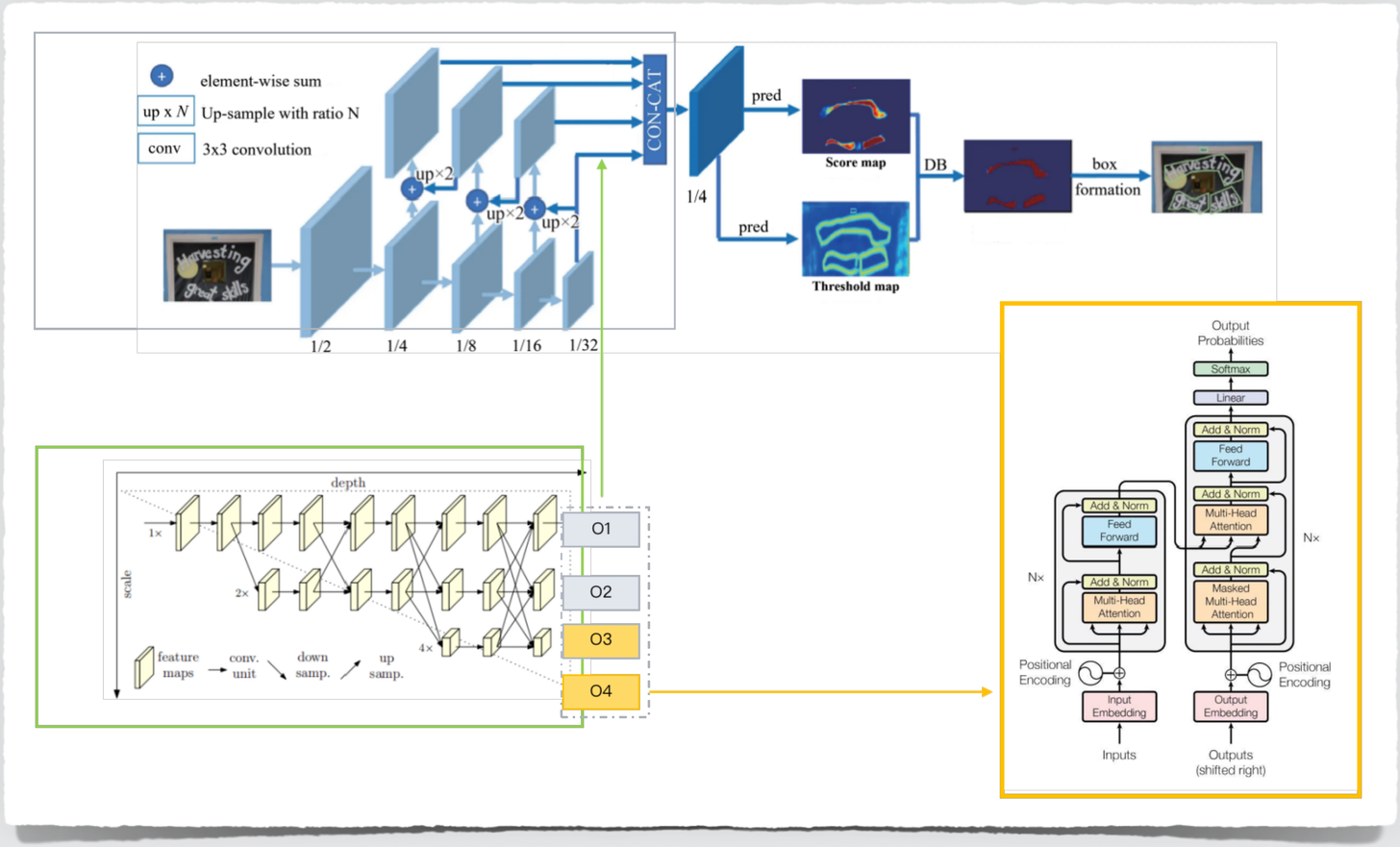
1. Multi-line texts are detected as one line(vertically or horizontally)
2. A couple of texts are missed
3. Noises are recognized as text lines
4. Horizontal texts are detected as vertical

04 Text detection scheme for table restoration

working together!

Embedding the Transformer Block in the neck of DBNet(Open source text detection method) to improve the contextual information and the effective receptive field coverage. Besides, we apply a pixel-level stochastic elastic transform in data augmentation to improve the accuracy of arbitrary text detection.





04 Text detection scheme for table restoration

working together!

- The popular CRNN scheme is adopted to get OCR results.
- The features proposed by CNN are fed into the classifier branch to obtain the orientation of current text line.

Difficult OCR scenes with multi orientations

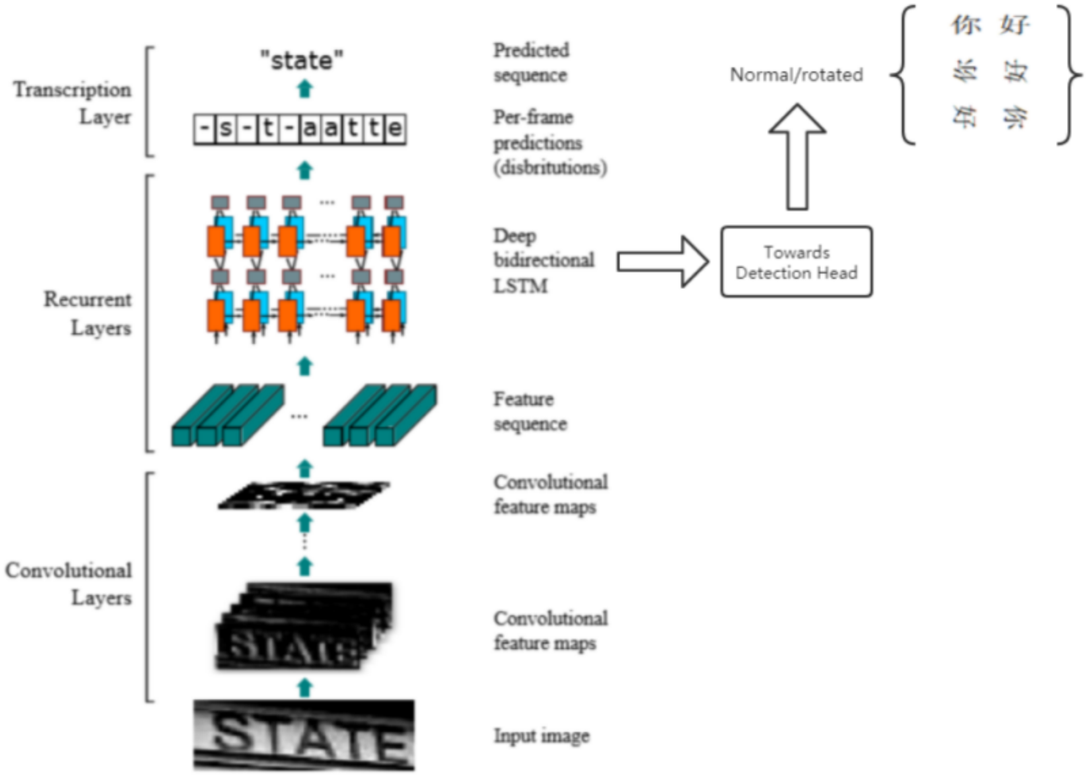
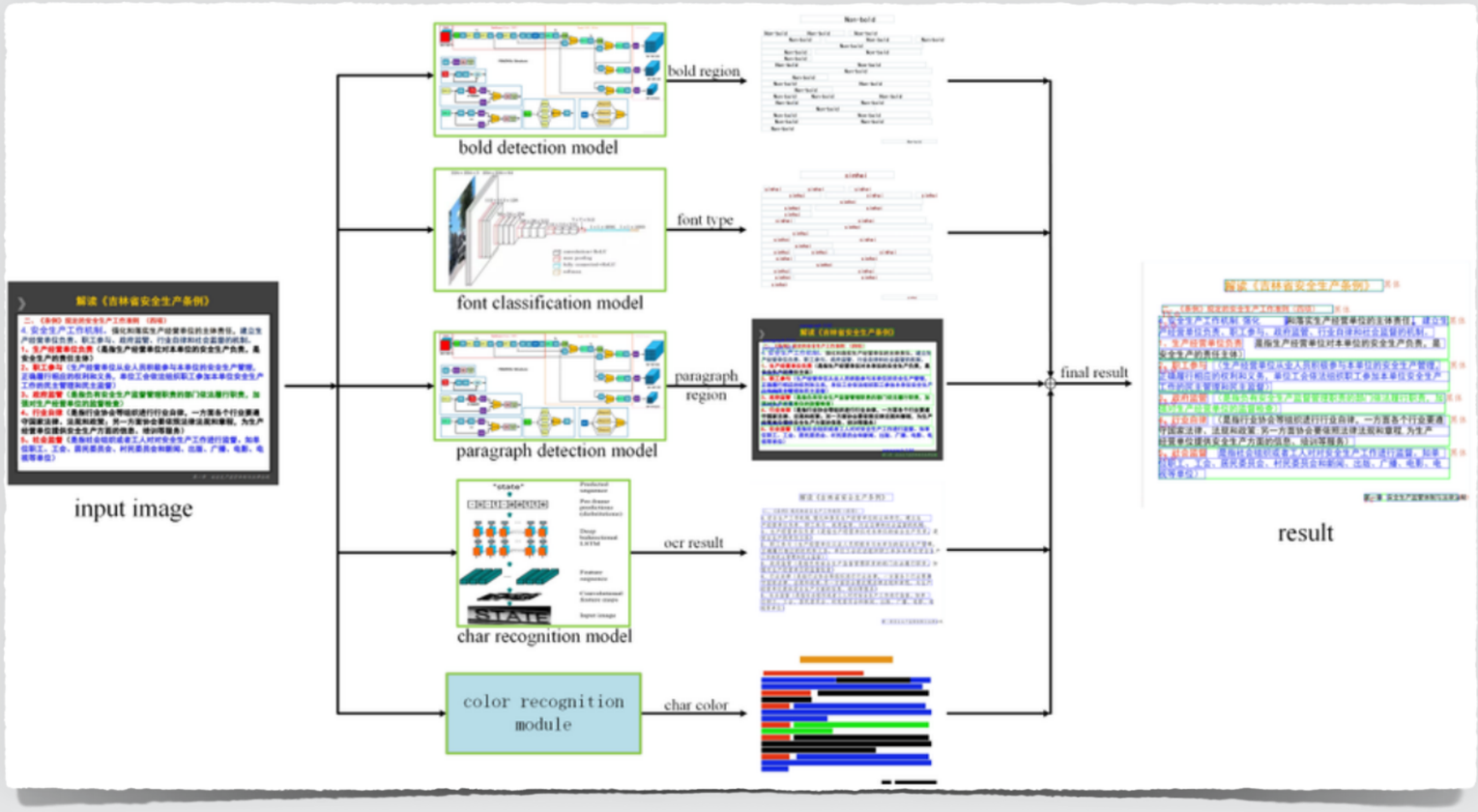


Figure 1. The network architecture. The architecture consists of three parts: 1) convolutional layers, which extract a feature sequence from the input image; 2) recurrent layers, which predict a label distribution for each frame; 3) transcription layer, which translates the per-frame predictions into the final label sequence.

04 Text detection scheme for table restoration

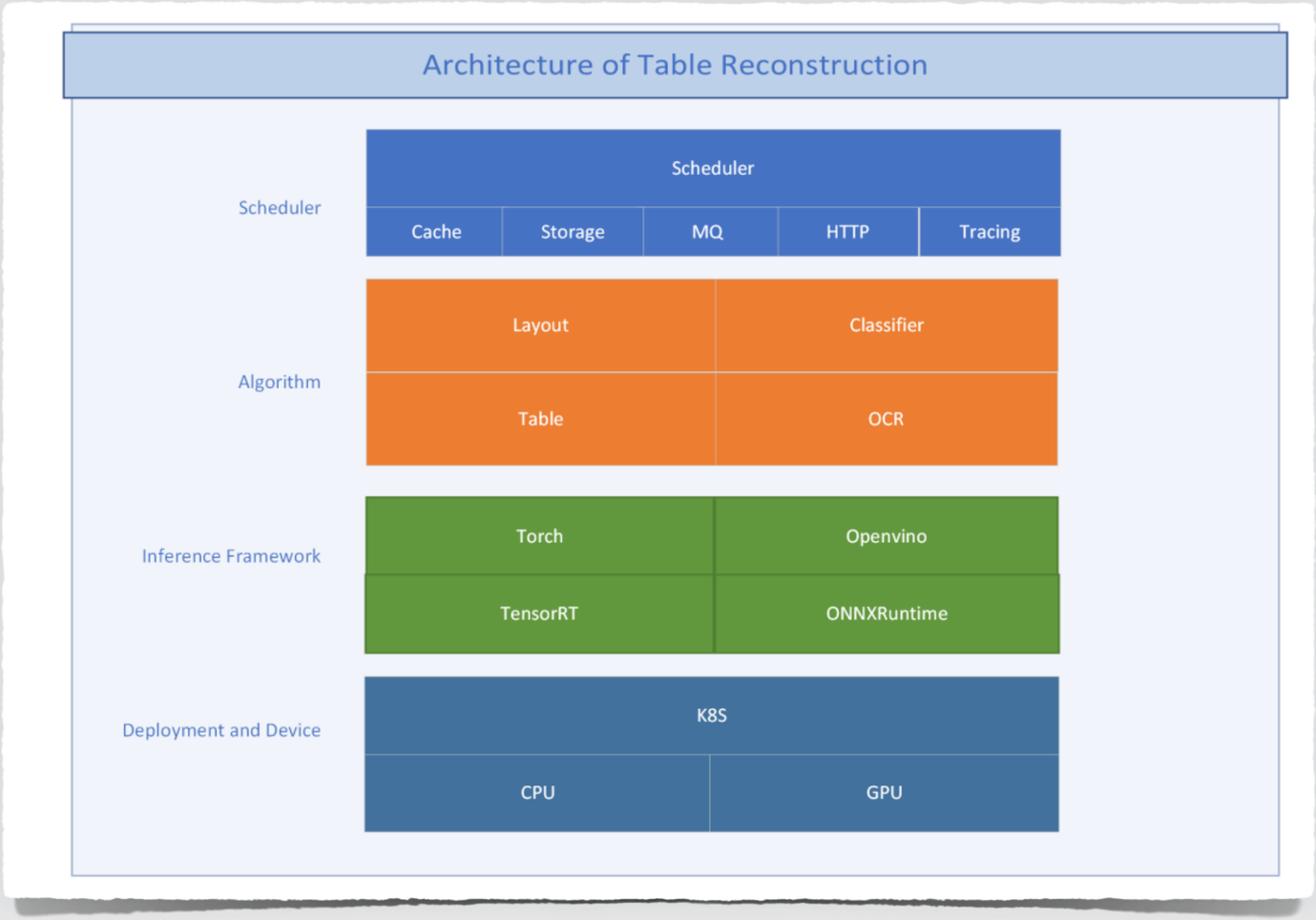
working together!

- **Bold detection module:** estimate bold attribute
- **Font recognition module:** analyze the type of fonts
- **Paragraph detection module:** analyze the paragraph information between the text bndboxes
- **Text recognition module:** recognize character based on detected text boxes
- **Text color recognition module:** determine the text color of the texts



05 System design and implementation

The service architecture consists of four levels: underlying hardware (cluster and service equipment), inference framework, algorithm module and scheduling module. And 5 main services: scheduler of the scheduling module, layout, classifier, table, and OCR of the algorithm module. The system can run on GPU hardware or pure CPU environment.



05 System design and implementation

working together!

05 System design and implementation

working together!

CPU
Intel® Core™
i7-8700 CPU @ 3.20GHz
Number of threads
12

Memory
16 GB
Time-consuming per page
11.38 S
Requests per minute
5.23

CPU
Intel® Xeon®
Gold 6240 CPU @ 2.60GHz
Number of threads
72
GPU
4 × Nvidia T4

Memory
128 GB
Time-consuming per page
2.8 S
Requests per minute
186.26

05 Real Cases

working together!

Problems	Causes	Advice
Feeling nervous	Too much homework; Have no time to enjoy hobbies	Make plans for studies and hobbies; Find time to relax as much as you can
Getting short-sighted (近视的)	Read and write in a bad way; Spend much time on computers	Do homework and read books in a correct way; Use computers to do something important
Feeling alone	Have no idea how to get on well with others	Make more friends and understand each other; Share your problem with your friends

Wang Xiaoman is 15 and she is from China. She studies in Class 2, Grade 8. She is a little short and of medium build. She has short hair. She likes sports and she is very popular at school.

Jason is 17 and he comes from the United States. Now he lives with his parents in China. He is in Class 9, Grade 9. His favorite subject is history. Look! He is wearing a white T-shirt and he has short curly hair.

This is Jill. He is 14 and he is from Japan. He studies in Class 6, Grade 8. He is very tall and has short straight hair. He likes reading and painting but he is a little quiet.

Selina is 16 and she comes from Canada. She is in Class 2, Grade 9. She is good-looking and likes telling jokes. She has long hair. She can sing well and she is in our school music club.

Short	Long
1. mop	mob
2. cup	cub
3. pat	pad
4. flack	flag
5. pup	pub
6. pick	pig

Problems	Causes	Advice
Feeling nervous	Too much homework;Have no time to enjoy hobbies	Make plans for studies and hobbies; Find time to relax as much as you can
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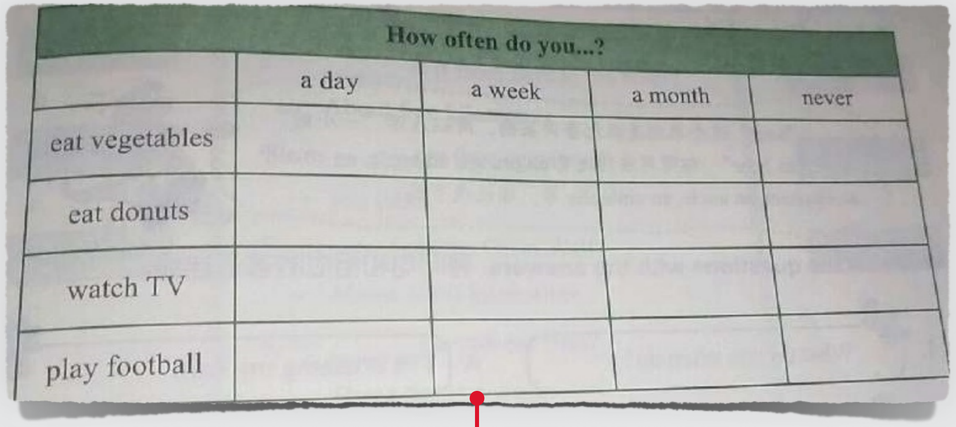
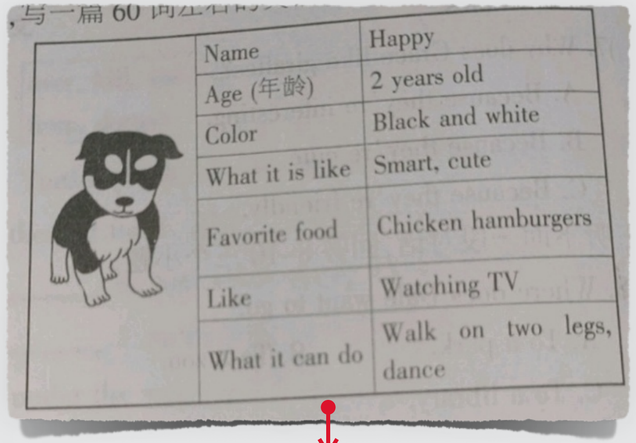
Short	Long
1. mop	mob
2. cup	cub
3. pat	pad
4. flack	flag
5. pup	pub
6. pick	pig

05 Real Cases



How often do you...?				
	a day	a week	a month	never
eat vegetables				
eat donuts				
watch TV				
play football				



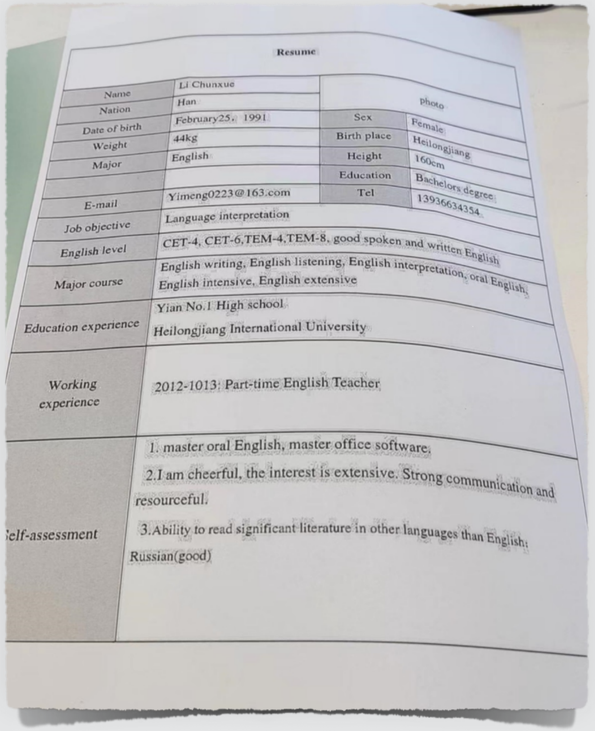
	Name	Happy
	Age (年龄)	2 years old
	Color	Black and white
	What it is like	Smart, cute
	Favorite food	Chicken hamburgers
	Like	Watching TV
	What it can do	Walk on two legs, dance

How often do you…?				
	a day	a week	a month	never
eat vegetables				
eat donuts				
watch TV				
play football				

	Name	Happy
	Age (年龄)	2 years old
	Color	Black and white
	What it is like	Smart. cute
	Favorite food	Chicken hamburgers
	Like	Watching TV
	What it can do	Walk on two legs, dance

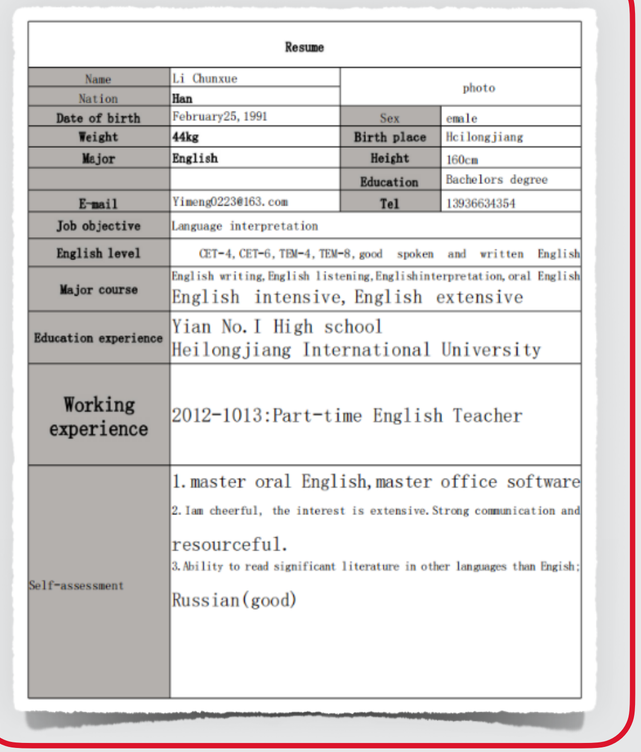
05 Real Cases

working together!



Resume

Name	Li Chunxue	photo	
Nation	Han		
Date of birth	February25, 1991	Sex	Female
Weight	44kg	Birth place	Heilongjiang
Major	English	Height	160cm
		Education	Bachelors degree
E-mail	Yimeng0223@163.com	Tel	13936634354
Job objective	Language interpretation		
English level	CET-4, CET-6, TEM-4, TEM-8, good spoken and written English		
Major course	English writing, English listening, English interpretation, oral English, English intensive, English extensive		
Education experience	Yian No.1 High school Heilongjiang International University		
Working experience	2012-1013: Part-time English Teacher		
Self-assessment	1. master oral English, master office software. 2.I am cheerful, the interest is extensive. Strong communication and resourceful. 3.Ability to read significant literature in other languages than English: Russian(good)		



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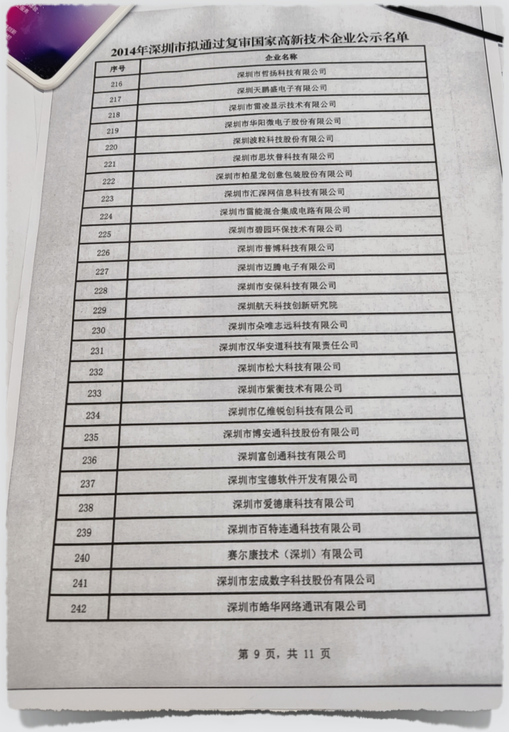

2014年深圳市拟通过复审国家高新技术企业公示名单

序号	企业名称
216	深圳市哲扬科技有限公司
217	深圳天鹏盛电子有限公司
218	深圳市雷凌显示技术有限公司
219	深圳市华阳微电子股份有限公司
220	深圳波粒科技股份有限公司
221	深圳市思坎普科技有限公司
222	深圳市柏星龙创意包装股份有限公司
223	深圳市汇深网信息科技有限公司
224	深圳市雷能混合集成电路有限公司
225	深圳市碧园环保技术有限公司
226	深圳市普博科技有限公司
227	深圳市迈腾电子有限公司
228	深圳市安保科技有限公司
229	深圳航天科技创新研究院
230	深圳市朵唯志远科技有限公司
231	深圳市汉华安道科技有限责任公司
232	深圳市松大科技有限公司
233	深圳市紫衡技术有限公司
234	深圳市亿维锐创科技有限公司
235	深圳市博安通科技股份有限公司
236	深圳富创通科技有限公司
237	深圳市宝德软件开发有限公司
238	深圳市爱德康科技有限公司
239	深圳市百特连通科技有限公司
240	赛尔康技术（深圳）有限公司
241	深圳市宏成数字科技股份有限公司
242	深圳市皓华网络通讯有限公司

第 9 页，共 11 页

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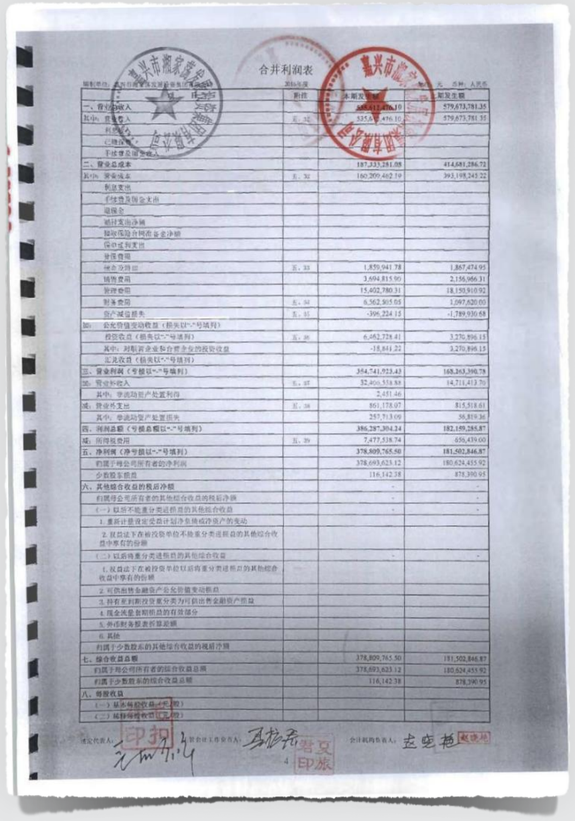
第 9 页，共 11 页

PDF association

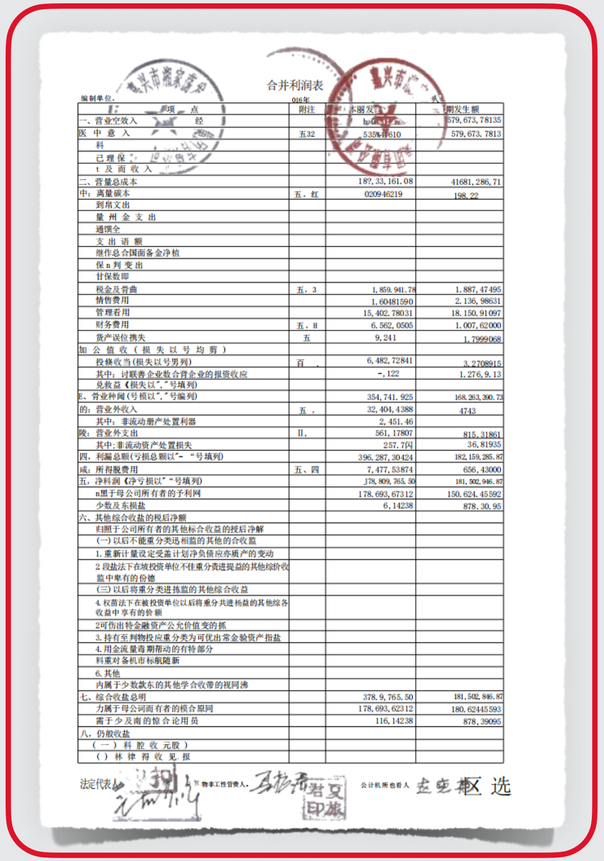
05 Real Cases

working together!



合并利润表

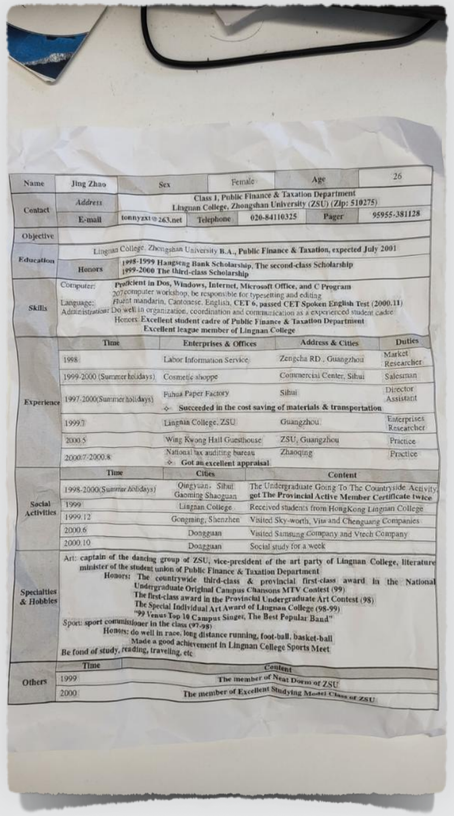
项目	附注	本期发生额	上期发生额
一、营业收入		579,673,781.35	579,673,781.35
其中：营业收入	五、32	579,673,781.35	579,673,781.35
利息收入			
已赚保费			
手续费及佣金收入			
二、营业总成本		187,333,381.08	41,681,286.72
其中：营业成本	五、32	160,209,462.59	393,198,245.22
利息支出			
手续费及佣金支出			
退保金			
赔付支出净额			
提取保险合同准备金净额			
保单红利支出			
分保费用			
税金及附加	五、33	1,859,941.78	1,867,474.95
销售费用		3,694,815.99	2,156,986.31
管理费用		15,402,780.31	18,150,910.92
财务费用	五、34	6,562,305.05	1,097,620.00
资产减值损失	五、35	-396,224.15	-1,789,930.68
加：公允价值变动收益（损失以"-"号填列）			
投资收益（损失以"-"号填列）	五、36	6,062,728.41	3,270,896.13
其中：对联营企业和合营企业的投资收益		-18,841.22	3,270,896.13
汇兑收益（损失以"-"号填列）			
三、营业利润（亏损以"-"号填列）		354,741,923.43	168,263,390.78
加：营业外收入	五、37	32,466,519.88	14,711,413.70
其中：非流动资产处置利得		2,411.46	
减：营业外支出	五、38	561,178.07	815,518.61
其中：非流动资产处置损失		257,713.09	36,819.36
四、利润总额（亏损总额以"-"号填列）		386,287,304.24	182,159,285.87
减：所得税费用	五、39	7,477,538.74	656,439.60
五、净利润（净亏损以"-"号填列）		378,809,765.50	181,502,846.87
归属于母公司所有者的净利润		378,693,623.12	180,624,455.92
少数股东损益		116,142.38	878,390.95
六、其他综合收益的税后净额			
归属母公司所有者的其他综合收益的税后净额			
（一）以后不能重分类进损益的其他综合收益			
1.重新计量设定受益计划净负债或净资产的变动			
2.权益法下在被投资单位不能重分类进损益的其他综合收益中享有的份额			
（二）以后将重分类进损益的其他综合收益			
1.权益法下在被投资单位以后将重分类进损益的其他综合收益中享有的份额			
2.可供出售金融资产公允价值变动损益			
3.持有至到期投资重分类为可供出售金融资产损益			
4.现金流量套期损益的有效部分			
5.外币财务报表折算差额			
6.其他			
归属于少数股东的其他综合收益的税后净额			
七、综合收益总额		378,809,765.50	181,502,846.87
归属于母公司所有者的综合收益总额		378,693,623.12	180,624,455.92
归属于少数股东的综合收益总额		116,142.38	878,390.95
八、每股收益			
（一）基本每股收益（元/股）			
（二）稀释每股收益（元/股）			



合并利润表

项目	附注	本期发生额	上期发生额
一、营业收入	五32	579,673,7813	579,673,781.35
减：营业成本		160,209,462.59	393,198,245.22
税金及附加	五、3	1,859,941.78	1,887,474.95
销售费用		1,6048159	2,136,98631
管理费用		15,402,78031	18,150,91097
财务费用	五、H	6,562,0005	1,097,62000
资产减值损失	五	9,241	1,7999068
加：公允价值变动收益（损失以"-"号填列）			
投资收益（损失以"-"号填列）	百	6,482,72841	3,2708915
其中：对联营企业和合营企业的投资收益		-,122	1,276,9,13
汇兑收益（损失以"-"号填列）			
二、营业利润（亏损以"-"号填列）		354,741,925	168,263,390,78
加：营业外收入	五、	32,466,4388	4743
其中：非流动资产处置利得		2,451,46	
减：营业外支出	H、	561,17807	815,31861
其中：非流动资产处置损失		257,7[illegible]	36,81935
四、利润总额（亏损总额以"-"号填列）		396,287,30424	182,159,285,87
减：所得税费用	五、四	7,477,53874	656,43000
五、净利润（净亏损以"-"号填列）		378,809,765,50	181,502,846,87
归属于母公司所有者的子利润		178,693,62112	180,624,45592
少数及东损益		6,14238	878,30,95
六、其他综合收益的税后净额			
归属于公司所有者的其他综合收益的授后净额			
（一）以后不能重分类进相监的其他的合收益			
1.重新计量设定受益计划净负债或净资产的变动			
2.权益法下在被投资单位不佳重分类进提益的其他综[illegible]收益中享有的份额			
（二）以后将重分类进搭监的其他综合收益			
4.权益法下在被投资单位以后将重分类进损益的其他综合收益中享有的份额			
2可伤出特金融资产公允价值变的抵			
3.持有至判投应重分类为可优出常金验资产指益			
4.用金流量毒期损动的有特部分			
料重对备机市标机题新			
6.其他			
内属于少数款东的其他学合收带的视同沸			
七、综合收益总明		378,9,765,50	181,502,846.87
力属于母公司商有者的根合原同		178,693,62112	180,62445593
属于少及商的愉合论用员		116,14238	878,39095
八、仍敢收益			
（一）科腔收元股）			
（）林律得收见报			

法定代表人：[illegible] 主管会计工作负责人：[illegible] 会计机构负责人：[illegible]



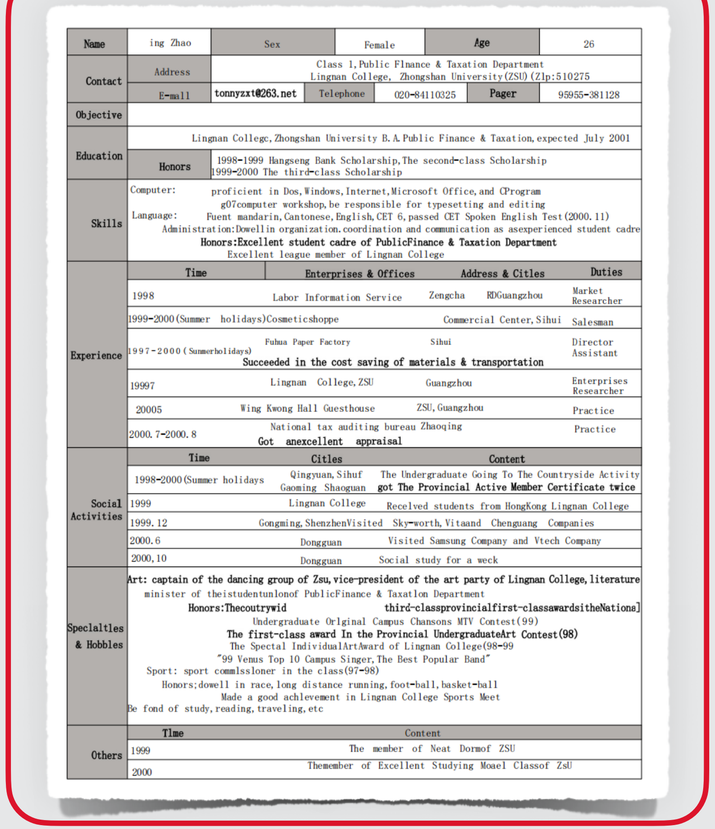
Name	Jing Zhao	Sex	Female	Age	26
Contact	Address	Class 1, Public Finance & Taxation Department Lingnan College, Zhongshan University (ZSU) (Zip: 510275)			
	E-mail	tonnyzxt@263.net	Telephone	020-84110325	Pager 95955-381128
Objective					
Education	Lingnan College, Zhongshan University B.A., Public Finance & Taxation, expected July 2001				
	Honors	1998-1999 Hangseng Bank Scholarship, The second-class Scholarship 1999-2000 The third-class Scholarship			
Skills	Computer: Proficient in Dos, Windows, Internet, Microsoft Office, and C Program g07computer workshop, be responsible for typesetting and editing Language: Fluent mandarin, Cantonese, English, CET 6, passed CET Spoken English Test (2000.11) Administration: Do well in organization, coordination and communication as a experienced student cadre Honors: Excellent student cadre of Public Finance & Taxation Department Excellent league member of Lingnan College				

Experience	Time	Enterprises & Offices	Address & Cities	Duties
	1998	Labor Information Service	Zengcha RD., Guangzhou	Market Researcher
	1999-2000 (Summer holidays)	Cosmetic shoppe	Commercial Center, Sihui	Salesman
	1997-2000(Summer holidays)	Fuhua Paper Factory	Sihui	Director Assistant
		◇ Succeeded in the cost saving of materials & transportation		
	1999.7	Lingnan College, ZSU	Guangzhou	Enterprises Researcher
	2000.5	Wing Kwong Hall Guesthouse	ZSU, Guangzhou	Practice
	2000.7-2000.8	National tax auditing bureau	Zhaoqing	Practice
	◇ Got an excellent appraisal			

Social Activities	Time	Cities	Content
	1998-2000(Summer holidays)	Qingyuan, Sihui Gaoming, Shaoguan	The Undergraduate Going To The Countryside Activity got The Provincial Active Member Certificate twice
	1999	Lingnan College	Received students from HongKong Lingnan College
	1999.12	Gongming, Shenzhen	Visited Sky-worth, Vitaand Chenguang Companies
	2000.6	Dongguan	Visited Samsung Company and Vtech Company
	2000.10	Dongguan	Social study for a week

Specialties & Hobbies	Art: captain of the dancing group of ZSU, vice-president of the art party of Lingnan College, literature minister of the student union of Public Finance & Taxation Department Honors: The countrywide third-class & provincial first-class award in the National Undergraduate Original Campus Chansons MTV Contest (99) The first-class award in the Provincial Undergraduate Art Contest (98) The Special Individual Art Award of Lingnan College (98-99) "99 Venus Top 10 Campus Singer, The Best Popular Band" Sport: sport commissioner in the class (97-98) Honors: do well in race, long distance running, foot-ball, basket-ball Made a good achievement in Lingnan College Sports Meet Be fond of study, reading, traveling, etc

Others	Time	Content
	1999	The member of Neat Dormo of ZSU
	2000	The member of Excellent Studying Model Class of ZSU



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	2000. 6	Dongguan	Visited Samsung Company and Vtech Company
	2000, 10	Dongguan	Social study for a week

Specialtles & Hobbles	Art: captain of the dancing group of Zsu, vice-president of the art party of Lingnan College, literature minister of theistudentunlonof PublicFinance & Taxation Department Honors: Thecoutrywid third-classprovincialfirst-classawardsitheNationa] Undergraduate Orlginal Campus Chansons MTV Contest(99) The first-class award In the Provincial UndergraduateArt Contest(98) The Spectal IndividualArtAward of Lingnan College(98-99 "99 Venus Top 10 Campus Singer, The Best Popular Band" Sport: sport commlssloner in the class(97-98) Honors: dowell in race, long distance running, foot-ball, basket-ball Made a good achlevement in Lingnan College Sports Meet Be fond of study, reading, traveling, etc

Others	Tlme	Content
	1999	The member of Neat Dormof ZSU
	2000	Themember of Excellent Studying Moael Classof ZsU

06 Summary and outlook

working together!

- Tables in scanned PDFs can be recognized and reconstructed by a series of algorithms, whether it is regular or deformed.
- Benefiting from deep learning techniques, picture-form-table regain its original and rich information.
- The entire set of technologies can rely on cloud or local GPU for computing, or run locally with CPU.
- User-experience get a sharp increase because the technologies speed up the whole process of reconstructing tables.
- The OCR and table structure recognition should still be improved, since they are not perfect.
- Calculation is not only time-consuming but also resource-consuming, so optimizing works are completely necessary for the future.

06 Reference

working together!

Test images are coming from:

[image in page13]
M. Liao, Z. Zou, Z. Wan, C. Yao and X. Bai, "Real-Time Scene Text Detection with Differentiable Binarization and Adaptive Scale Fusion," in IEEE Transactions on Pattern Analysis and Machine Intelligence, doi: 10.1109/TPAMI.2022.3155612.
Ashish Vaswani, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Łukasz Kaiser, Illia Polosukhin， “Attention is All you Need“， Neural Information Processing Systems 30 (NIPS 2017)

[image in page16]
B. Shi, X. Bai and C. Yao, "An End-to-End Trainable Neural Network for Image-Based Sequence Recognition and Its Application to Scene Text Recognition," in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 39, no. 11, pp. 2298-2304, 1 Nov. 2017, doi: 10.1109/TPAMI.2016.2646371.

[Image in page 21&22]
From the TAL_OCR_TABLE table recognition competition dataset

[image in page23, left]
https://appwk.baidu.com/naapi/doc/view?ih=887&o=jpg_6_0_____&iw=730&ix=0&iy=0&aimw=730&rn=1&doc_id=40375504f111f18583d05ac4&pn=1&sign=2a5859911c2357671151333435ffbfe3&type=1&app_ver=2.9.8.2&ua=bd_800_800_IncredibleS_2.9.8.2_2.3.7&bid=1&app_ua=IncredibleS&uid=&cuid=&fr=3&Bdi_bear=WIFI&from=3_10000&bduss=&pid=1&screen=800_800&sys_ver=2.3.7

[image in page23, right]
http://www.innocom.gov.cn/gqrdw/c101430/201804/0e7b46ce49a842af9e200be593028d08/files/34974c607b404045a6429e90ceed0f6c.pdf

[image in page24, right]
https://gimg2.baidu.com/image_search/src=http%3A%2F%2Fwww.mianfeiwendang.com%2Fpic%2F3a32322434789161cdfc65c4%2F1-1056-jpg_6_0_____-836-0-0-836.jpg&refer=http%3A%2F%2Fwww.mianfeiwendang.com&app=2002&size=f9999,10000&q=a80&n=0&g=0n&fmt=auto?sec=1658887052&t=ca5497b8378cec4ccdba28d4903d0164

working together!

Questions & Answers

working together!

Thank you, Danke schön!

谢谢您的聆听

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