

Visual Understanding of Complex Table Structures from Document Images

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1. Organization

We organize our supplementary paper in the following manner:

- Sections 2 through 4 describe the implementation details along with specific pre-processing and post-processing steps that would help to reproduce our results.
- Section 5 discuss the comparative analysis on the performance of the proposed method over existing techniques on various benchmark datasets for both physical and logical table structure recognition tasks.
- Section 6 shows some qualitative results obtained by the proposed method.

2. Implementation Details

Both networks - TOD-Net and TSR-Net have been trained and evaluated with the table images scaled to a fixed size of 1536×1536 while maintaining the original aspect ratio as the input. We use NVIDIA TITAN X GPU with 12 GB memory for our experiments and a batch-size of 1. We use a dilated convolution with the filter size of 2×2 and a dilation parameter of 2. Also, we use the ResNet-101 backbone that is pre-trained on MS-COCO dataset. To compute region proposals, we use 0.5, 1 and 2 as the anchor scale and anchor box sizes of 8, 16, 32, 64 and 128. Further, for the generation of the row/column adjacency matrices, we use 2400 as the maximum number of vertices keeping in mind dense tables. Since every input table may contain hundreds of table cells, training can be a time-consuming process. To achieve faster training, we employ a 2-stage training process. During both stages, we use 0.001 as the learning rate, 0.9 as the momentum, and 0.0001 as the weight decay regularization.

To achieve faster training, we employ a 2-stage training process. In the first step, we use 2014 anchors and 512 RoIs. With this setting, the model can learn high and low-level features but resulted in many false negatives. To combat this, network is trained with 3072 anchors and 2048 RoIs. This significantly reduces the number of false negatives. For the first step, we train a total of 30 epochs, for the

first 8, we train all FPN and subsequent layers, for the next 15, we train FPN + last 4 layers of ResNet-101 and for the last 7 epochs, we train all the layers of the model. For the second step, we train a total of 10 epochs, for the first 3, we train all FPN and subsequent layers, for the next 4, we train FPN + last 4 layers of ResNet-101 and for the last 3 epochs, we train all the layers of the model. During both stages, we use 0.001 as the learning rate, 0.9 as the momentum, and 0.0001 as the weight decay regularisation.

3. Dataset Pre-processing

We use FinTabNet [41] dataset to train TOD-Net for cell, row, and column detection. Since FinTabNet has bounding boxes wrapped around the cell's content, we pre-process the ground truth to obtain cell level coordinates. To do that, we first find out the minimum and maximum x and y coordinates for every row and column based on the content boxes. We then split the y-coordinate difference between adjacent rows by half and extend the maximum y end coordinate of the previous row and reduce the current row's minimum y-coordinate accordingly. Similarly, we split the x-coordinate difference between adjacent columns by half and extend the maximum x end coordinate of the previous column and reduce the minimum x-coordinate of the current column accordingly. The resulting dataset follows all the constraints that we model in the TOD-Net. Please refer figures 1 and 2 for a step-by-step visual illustration of our algorithm.

4. Post-processing after Detection of Rows and Columns

After obtaining row and column bounding boxes, we employ additional post-processing steps to get cell bounding boxes along with the tabular structure in terms of row and column spans. The first step is to obtain cells by finding intersections of row and columns. If a row and column overlap with greater than 75% area, it is most likely a cell that spans multiple rows and/or columns. Further, rectilinear adjacencies output also helps in locating multi-row and multi-column spanning cells. Next step includes the removal of objects that have a high overlap with oth-

ers. Removal of some objects might result in some empty regions that are then filled-up based on the average height of rows and columns' average width. If the gap between sorted adjacent objects is greater than the average height of the column's row or average width, we add extra row(s) or column(s) in that empty space. In the other case, we split the gap between the adjacent objects to remove any gap or any small overlapping region that was missed from the first step. Next, we use Tesseract's [28] HOCR (open standard of data representation for formatted text obtained from optical character recognition) output to finetune cells' bounding boxes. This is done by first identifying words belonging to every cell and updating start and end coordinates in a way such that the content gets completely encapsulated within the cell boxes. This particularly helps us in making sure that as much content of a cell gets retained as possible thereby reducing false negatives with respect to content. After doing this, we align the y-coordinates of detected rows and the x-coordinates of the detected columns based on the output of the previous step. Rectilinear adjacencies help in building associations between cells. Adjacent cells that have high overlap areas and positive adjacencies are said to belong to the same row or column. Overlapping area percentage helps in resolving conflicting cases for some pair of cells where the rectilinear adjacencies output is not completely accurate.

5. Quantitative Results

Table 1 presents physical table structure recognition using the proposed method and comparison with the state-of-the-art techniques on UNLV [27] dataset. Tables 2 and 3 illustrate logical table structure recognition using the proposed method and comparison with state-of-the-art techniques on PubTabNet [42] and TableBank [17] datasets, respectively. Table 4 further presents results across varying IoU thresholds.

6. Qualitative Results

Please refer figures 3 through 12 for visual results on sample table images from scientific and business domains tested on standard evaluation datasets. Please observe that for every table image sample, we provide 6 images — (i) original test table image, (ii) Tesseract's [28] HOCR output, (iii) cells detection output using TOD-Net[†], (iv) cells detection output using TOD-Net[‡], (v) structure showing rows in alternating green, red and blue colors, and (vi) structure showing columns in alternating green, red and blue colors.

Figure 3 clearly shows the performance of our method on a sample ICDAR-2013 [8] dataset in the presence of horizontal and vertical separators where the table image contains many empty cells. What is interesting to note in this example is that the Tesseract output gets messed up as part

of the horizontal and vertical separators get falsely recognised as legitimate characters. Figure 4 shows the robustness of our method on a sample image from ICDAR-2019 [7] archival tables dataset. Furthermore, the superiority of our method is bolstered for both dense and sparse tables from Figures 5, 9 and 11. A sample image from TableBank [17] dataset, Figure 6 also demonstrates qualitative performance for table containing multi-line cells.

Effect of Trainable Loss Weights In our experiments, we used dynamic loss weights for each of the three loss weights based on the region of interest's visual characteristics. Figure 13 shows that with the same weight initialization, the model with dynamic loss weights converges faster and slightly better by 0.4%.

Method	Training Dataset	Test on UNLV					
		SEC			NEC		
		P↑	R↑	F1↑	P↑	R↑	F1↑
DGCNN [†] [22,24]	FinTabNet	0.849	0.833	0.841	0.827	0.810	0.818
DGCNN [‡] [22,24]	FinTabNet	0.873	0.867	0.870	0.858	0.851	0.854
SPLIT [30]	Private	0.795	0.776	0.785	0.748	0.715	0.731
TS-Net [24]	FinTabNet	0.852	0.834	0.843	0.833	0.819	0.826
Ours [†]	FinTabNet	0.867	0.849	0.858	0.852	0.838	0.845
Ours [‡]	FinTabNet	0.890	0.884	0.887	0.882	0.876	0.879

Table 1. Shows the performances of the proposed networks and its comparison against the existing techniques on physical table structure recognition in ICDAR-2019 dataset. DGCNN[†] indicates TOD-Net[†]+DGCNN+PP, DGCNN[‡] indicates TOD-Net[‡]+DGCNN+PP TS-Net indicates TabStruct-Net, Ours[†] indicates TOD-Net[†]+TSR+PP, and Ours[‡] indicates TOD-Net[‡]+TSR+PP. IoU threshold is set to 0.6. **P:** indicates precision, **R:** indicates recall, and **F1:** indicates F1 score.

Method	Training		Average Over Test Set (PubTabNet [40])		
	Dataset	#Image	TEDS↑		
EDD [40]	PubTabNet [40]	420K			88.30
TabStruct-Net [24]	ScitSR [4]	012K			90.10
TOD-Net [†] +TSR+PP	FinTabNet [39]	91K			89.50
TOD-Net [‡] +TSR+PP	FinTabNet [39]	91K			90.70

Table 2. Shows the performances of the proposed networks and its comparison against the existing techniques on logical table structure recognition in PubTabNet [40] dataset. IoU threshold is set to 0.6. **TEDS:** indicates Tree-Edit-Distance-based Similarity.

Method	Training		Average Over Test Set		
	Dataset	#Image	Document Type		
			Text	Latex	Text+Latex
			BLEU↑	BLEU↑	BLEU↑
Image-to-Text (Word) [17]	TableBank [17]	145K	0.751	0.673	0.714
Image-to-Text (Latex) [17]	TableBank [17]	145K	0.405	0.765	0.582
Image-to-Text (Word+Latex)[17]	TableBank [17]	145K	0.712	0.765	0.738
TabStruct-Net [24]	ScitSR [4]	012K	0.914	0.937	0.916
TOD-Net [†] +TSR+PP	FinTabNet [39]	091K	0.920	0.944	0.927
TOD-Net [‡] +TSR+PP	FinTabNet [39]	091K	0.924	0.955	0.937

Table 3. Shows the performances of the proposed networks and its comparison against the existing techniques on logical table structure recognition in TableBank [17] dataset.

Method	IoU	FinTabNet		ICDAR-13		Sci-TSR		TUCD	
		CD-F1↑	TSR-F1↑	CD-F1↑	TSR-F1↑	CD-F1↑	TSR-F1↑	CD-F1↑	TSR-F1↑
TabStruct-Net [24]	0.5	0.911	0.898	0.922	0.904	0.899	0.876	0.916	0.90
		0.930	0.906	0.92	0.903	0.907	0.88	0.911	0.889
		0.951	0.944	0.924	0.904	0.92	0.894	0.932	0.918
TabStruct-Net [24]	0.6	0.874	0.848	0.91	0.886	0.891	0.864	0.896	0.871
		0.915	0.892	0.918	0.903	0.90	0.878	0.911	0.889
		0.944	0.920	0.926	0.904	0.92	0.894	0.932	0.918
TabStruct-Net [24]	0.7	0.732	0.704	0.746	0.72	0.705	0.682	0.74	0.722
		0.830	0.802	0.846	0.82	0.785	0.746	0.822	0.797
		0.884	0.868	0.88	0.852	0.858	0.823	0.866	0.839
TabStruct-Net [24]	0.8	0.547	0.496	0.644	0.597	0.611	0.565	0.638	0.582
		0.603	0.561	0.726	0.675	0.683	0.637	0.70	0.659
		0.715	0.680	0.80	0.748	0.76	0.714	0.792	0.735
TabStruct-Net [24]	0.9	0.195	0.120	0.375	0.292	0.326	0.255	0.347	0.289
		0.368	0.325	0.396	0.307	0.347	0.296	0.37	0.301
		0.452	0.404	0.508	0.454	0.425	0.368	0.464	0.408

Table 4. Shows the comparison between the performances of the proposed network and TabStruct-Net [?] on cell detection and table structure recognition of dataset over various IoU thresholds. CD: indicates cell detection and TSR: indicates table structure recognition. TOD-Net[†]: indicates TOD-Net for direct cell detection and TOD-Net[‡]: indicates cell detection through intersection of row and column predictions using TOD-Net. We use FinTabNet [?] dataset for training.

(a)

(h)

(c)

Figure 1. Present modification of content level bounding box annotation to cell bounding box annotation using the proposed pre-processing algorithm. (a) shows original ground truth content level bounding box annotations, (b) intermediate annotation of cell level bonding box, and (c) final annotation of cell level bounding box.

Year Ended December 31,								
	2008	2007	2006		2008	2007	2006	
	(In thousands)				(In thousands)			
CASH FLOWS FROM OPERATING ACTIVITIES:								
Net income	\$ (21,793)	\$ (16,161)	\$ (19,608)		\$ 117,891	\$ 184,061	\$ 180,605	
Adjustments to reconcile net income to net cash provided by operating activities:								
Depreciation and amortization	82,041	72,929	72,770		79,041	73,759	73,771	
Provision for doubtful accounts	8,433	8,523	8,058		54,533	56,243	43,053	
Fair value gain on interest-only strip	(31,065)	(36,953)	(19,470)		131,051	139,958	119,470	
Provision for doubtful accounts					120,924	120,924	—	
Loss on sale of assets	(2,564)	(6,043)	(1,471)					
Change in trade accounts receivable	(17,612)	(21,429)	(5,071)		17,612	18,324	20,241	
Change in other assets	145,162	129,640	11,292		152,866	138,912	47,082	
Change in accrued and accrued expenses	35,277	40,566	33,292		32,615	39,866	43,353	
Change in deferred revenue	7,312	10,207	1,041		7,312	10,207	1,041	
Data acquisition costs	2,407	2,807	27,555		2,407	2,807	27,555	
Proceeds from sale of credit and receivable portfolios	105,966	125,846	137,954		105,966	125,846	137,954	
Proceeds from sale of notes receivable	1,861	8,728	18,281		1,861	8,728	18,281	
Other					8,613	6,729	8,291	
Net cash provided by operating activities	851,038	871,521	897,910		453,019	521,391	497,810	
CASH FLOWS FROM INVESTING ACTIVITIES:								
Change in receivables, net	131,501	147,473	139,762		131,501	147,473	139,762	
Proceeds from sales of property, plant and equipment	1,008	1,008	1,008		14,098	14,098	10,830	
Proceeds from the sale of assets								
Proceeds from the sale of credit and receivable portfolios to the securitization trusts	(18,000)	(18,000)	(18,000)					
Change in investments in the stock of an investee—cost basis	131,652	131,652	131,652		131,652	131,652	131,652	
Net increase in seller's interest and credit card receivables	16,335	117,691	120,764		16,335	117,691	120,764	
Capitalized software	13,962	13,962	13,962		13,962	13,962	13,962	
Proceeds from the sale of businesses	13,962	13,962	13,962		13,962	13,962	13,962	
Net cash used in investing activities	332,518	169,809	(477,002)		312,518	169,809	(477,002)	
CASH FLOWS FROM FINANCING ACTIVITIES:								
Proceeds from issuance of convertible senior notes	876,410	2,300,000	855,869		3,754,416	2,300,000	329,409	
Proceeds from issuance of common stock	80,000	1,000	1,000		805,000	1,000	1,000	
Certificates of deposit issued	1,000	1,000	1,000		999,000	2,111,000	1,345,000	
Payment of capital lease obligations	12,501	114,481	17,975		126,950	294,000	336,300	
Proceeds from employee benefit plans	13,252	13,252	13,252		132,901	134,851	17,935	
Proceeds from stock-based compensation	30,025	30,025	30,025		34,251	35,949	31,757	
Proceeds from issuance of warrants	1,000	1,000	1,000		30,920	30,892	48,831	
Proceeds from issuance of debt securities	1,000	1,000	1,000		1,001	1,001	1,000	
Purchase of treasury shares	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)	(1,000)	
Net cash used in financing activities	(20,366)	189,075	112,279		(20,366)	197,075	112,270	
Effect of exchange rate changes on cash and cash equivalents								
Change in cash and cash equivalents at beginning of year	10,824	11,762	12,054		265,839	180,075	143,713	
Cash and cash equivalents at end of year*	\$ 158,911	\$ 265,839	\$ 180,075		\$ 56,911	\$ 180,075	\$ 143,713	
SUPPLEMENTAL CASH FLOW INFORMATION:								
Interest paid	\$ 62,795	\$ 78,958	\$ 40,628		68,395	78,958	40,628	
Income taxes paid, net of refunds	\$ 113,987	\$ 107,516	\$ 141,935		\$ 113,987	\$ 107,516	\$ 141,935	
	Period Capital in Excess of Par Value	Common Shares	Additional Trust Shares	Treasury Stock	Period Capital in Excess of Par Value	Common Shares	Additional Trust Shares	Treasury Stock
(Millions of dollars)					(Millions of dollars)			
Balance at December 31, 2004	\$ 2,293	1,000	1,000	1,000	\$ 2,293	1,000	1,000	1,000
Cash dividends paid	44	178	178	178	44	178	178	178
Common shares purchased	75	75	75	75	75	75	75	75
Total dividends and other transactions	44	333	303	291	44	333	303	291
Adebowale trust shares	208	2,033	(2,335)	2	208	2,033	(2,335)	2
Comprehensive income (loss)								
Net income								
Other comprehensive income:								
Comprehensive income (loss) adjustment								
Reclassification of deferred benefit plan assets								
Included in net income								
Included in comprehensive income (loss) adjustment								
Retirement plan losses included in net income								
Retirement plan losses included in comprehensive income (loss) adjustment								
Included in net loss								
Net unrealized losses on available-for-sale securities, net of tax benefit of \$27								
Net unrealized losses on investment securities, net of tax benefit of \$27								
Retirement plan losses included in net income and derivatives, net of tax benefit of \$27								
Retirement plan losses included in comprehensive income (loss) adjustment								
Total comprehensive income (loss)								
Total comprehensive income (loss)								
Total dividends and other transactions								
Stock dividends	116	116	116	116	116	116	116	116
Common shares purchased	133	133	133	133	133	133	133	133
Tax benefit from exercise of options	33	33	33	33	33	33	33	33
Total dividends and other transactions	116	272	116	116	116	272	116	116
Stock-based compensation	117	117	117	117	117	117	117	117
Reclassification of deferred benefit plan assets	198	198	198	198	198	198	198	198
Adoption of SFAS No. 158, net of tax								
Adoption of SFAS No. 158, net of tax								
Retirement plan losses included in net income								
Retirement plan losses included in comprehensive income (loss) adjustment								
Included in net loss								
Net unrealized gains on investment securities, net of tax benefit of \$27								
Net unrealized gains on derivatives, net of tax benefit of \$27								
Retirement plan gains included in net income and derivatives, net of tax benefit of \$27								
Retirement plan gains included in comprehensive income (loss) adjustment								
Total unrealized gains on investment securities, net of tax provision of \$60								
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Retirement plan gains included in net income and derivatives, net of tax provision of \$60								
Retirement plan gains included in comprehensive income (loss) adjustment								
Total unrealized gains on investment securities, net of tax provision of \$60								
Total unrealized gains on derivatives, net of tax provision of \$60								
Retirement plan gains included in net income and								

Measure	Age 4 (Head Start Year)	K	1 Grade	3 Grade
Language, Literacy, and Pre-Writing				
Color Identification	0.16	NA	NA	NA
Pre-Writing (McCarthy Draw a Design)		NA	NA	NA
Emergent Literacy Scale (parent report)	0.31	NA	NA	NA
Letter Naming	0.25	NA	NA	NA
Test of Phonological Processing (CTOPPP Elision)		NA	NA	NA
Receptive Vocabulary (PPVT)	0.09	0.09		
Letter-Word Identification (WJIII)	0.22			
Spelling (WJIII)	0.15	NA		
Oral Comprehension (WJIII)		NA		
Pre-Academic Skills (WJIII)	0.19	NA		
Phonetic Skills/ Word Attack (WJIII)		NA		
Basic Reading (WJIII)		NA		
Academic Applications (WJIII)		NA		
Academic Skills (WJIII)		NA		
Passage Comprehension (WJIII)		NA		
ELA & Reading Comprehension		0.11		
Writing Sample (WJIII)		NA		
Spanish Language				
Receptive Vocabulary (TVIP)				
Batería WM Identificación de letras y palabras				NA
Math				
One-to-One Counting (Counting Bears)		NA	NA	NA
Applied Problems (WJIII)				
Quantitative Concepts (WJIII)		NA		
Math Reasoning (WJIII)		NA		
Calculation (WJIII)		NA		
School Performance				
School Accomplishments		NA		
Promotion (parent report)		NA		
Language and Literacy Ability		NA		
Math Ability		NA		
Math Skills		NA	NA	NA
Reading/Language Arts Skills		NA	NA	NA
Social Studies and Science Ability		NA		NA
Language, Literacy, and Pre-Writing				
Color Identification	0.16	NA	NA	NA
Pre-Writing (McCarthy Draw a Design)		NA	NA	NA
Emergent Literacy Scale (parent report)	0.31	NA	NA	NA
Letter Naming	0.25	NA	NA	NA
Test of Phonological Processing (CTOPPP Elision)		NA		NA
Receptive Vocabulary (PPVT)	0.09	0.09		
Letter-Word Identification (WJIII)	0.22			
Spelling (WJIII)	0.15			NA
Oral Comprehension (WJIII)		NA		
Pre-Academic Skills (WJIII)	0.19			NA
Phonetic Skills/ Word Attack (WJIII)		NA		
Basic Reading (WJIII)		NA		
Academic Applications (WJIII)		NA		NA
Academic Skills (WJIII)		NA		NA
Passage Comprehension (WJIII)		NA		NA
ELA & Reading Comprehension		0.11		
Writing Sample (WJIII)		NA		NA
Spanish Language				
Receptive Vocabulary (TVIP)				
Batería WM Identificación de letras y palabras				NA
Math				
One-to-One Counting (Counting Bears)		NA	NA	NA
Applied Problems (WJIII)				
Quantitative Concepts (WJIII)		NA		
Math Reasoning (WJIII)		NA		
Calculation (WJIII)		NA		
School Performance				
School Accomplishments		NA		
Promotion (parent report)		NA		
Language and Literacy Ability		NA		
Math Ability		NA		
Math Skills		NA	NA	NA
Reading/Language Arts Skills		NA	NA	NA
Social Studies and Science Ability		NA		NA
Language, Literacy, and Pre-Writing				
Color Identification	0.16	NA	NA	NA
Pre-Writing (McCarthy Draw a Design)		NA	NA	NA
Emergent Literacy Scale (parent report)	0.31	NA	NA	NA
Letter Naming	0.25	NA	NA	NA
Test of Phonological Processing (CTOPPP Elision)		NA		NA
Receptive Vocabulary (PPVT)	0.09	0.09		
Letter-Word Identification (WJIII)	0.22			
Spelling (WJIII)	0.15			NA
Oral Comprehension (WJIII)		NA		
Pre-Academic Skills (WJIII)	0.19			NA
Phonetic Skills/ Word Attack (WJIII)		NA		
Basic Reading (WJIII)		NA		NA
Academic Applications (WJIII)		NA		NA
Academic Skills (WJIII)		NA		NA
Passage Comprehension (WJIII)		NA		NA
ELA & Reading Comprehension		0.11		
Writing Sample (WJIII)		NA		NA
Spanish Language				
Receptive Vocabulary (TVIP)				
Batería WM Identificación de letras y palabras				NA
Math				
One-to-One Counting (Counting Bears)		NA	NA	NA
Applied Problems (WJIII)				
Quantitative Concepts (WJIII)		NA		
Math Reasoning (WJIII)		NA		
Calculation (WJIII)		NA		
School Performance				
School Accomplishments		NA		
Promotion (parent report)		NA		
Language and Literacy Ability		NA		
Math Ability		NA		
Math Skills		NA	NA	NA
Reading/Language Arts Skills		NA	NA	NA
Social Studies and Science Ability		NA		NA

Figure 3. Illustrates visual results of ICDAR-2013. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

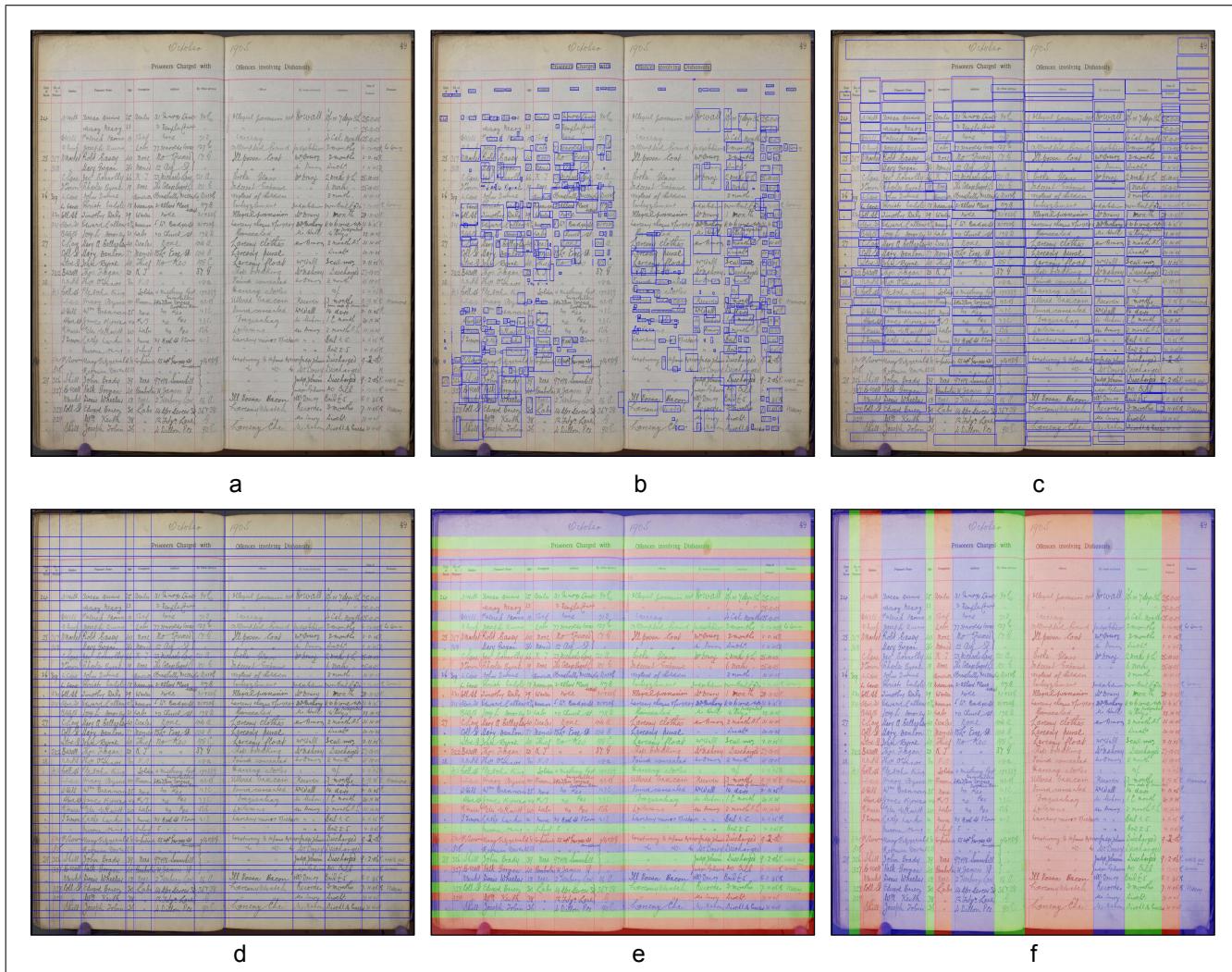


Figure 4. Illustrates visual results of ICDAR-2019. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

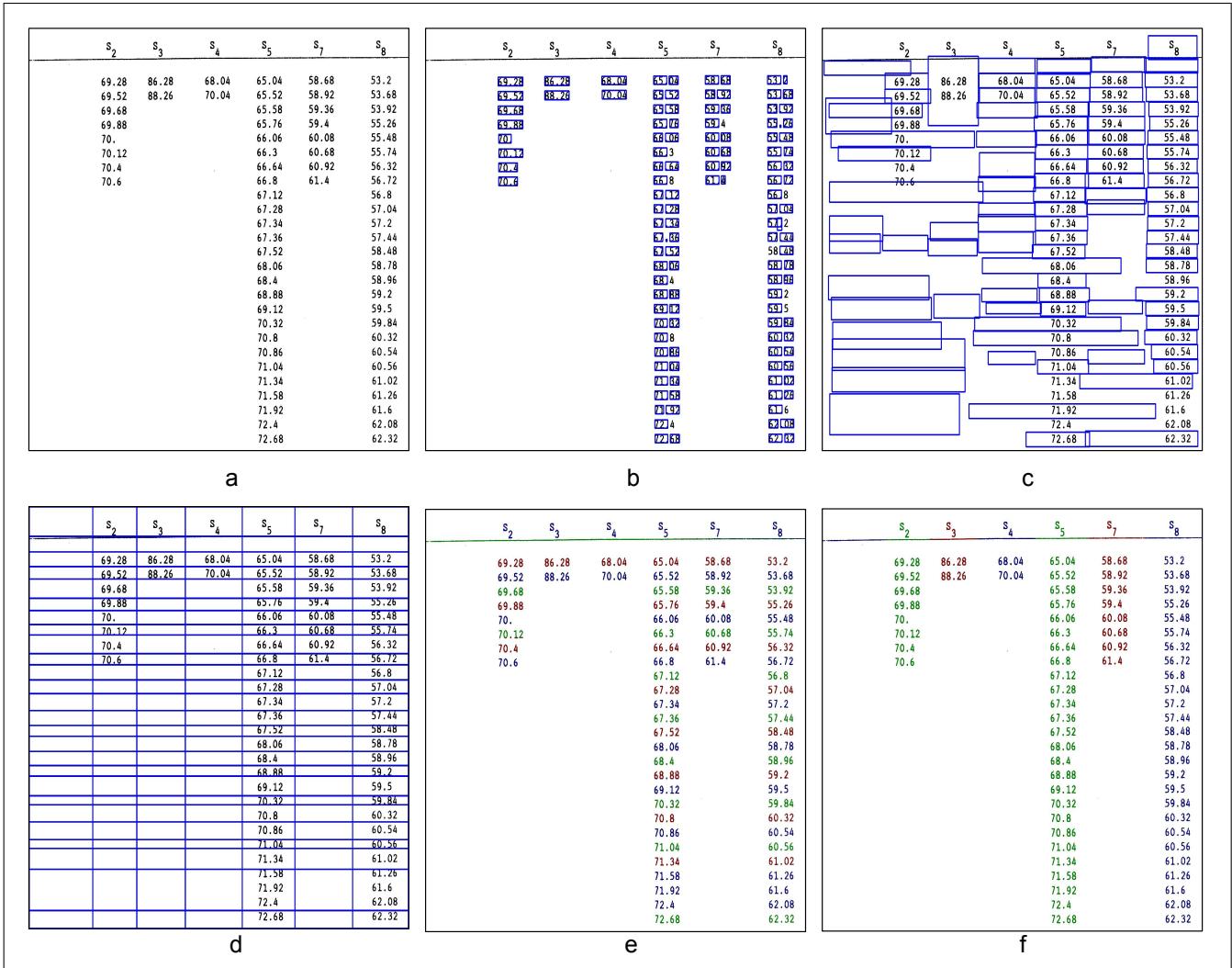


Figure 5. Illustrates visual results of UNLV. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

Scored Requirements	Weight	Does Not Meet	Partially Meets	Meets	Exceeds
Offerer Requirement: The Offeror, or subcontractor, should have at least one (1) successful experience with assisting a Public, Federal, State, Local Government Agency, Institution of Higher Education, Fortune 500 Global Company (and its subsidiary) to define and execute on a Data Management solution within the last forty (40) months as indicated in Supplement 1, Section 2.1.	5	0	2	5	7
MDM Solution Architecture and Data Privacy: Supplement 1, Section 2.0 and Supplement 2, Section 3.0	10	0	2	5	7
Solution and Implementation Plan: Other Benefits expansion and applicable upgrade; Supplement 1, Section 2.3 and Section 3.0, as applicable.	15	0	2	5	7
Solution and Implementation Plan - Enterprise MDM Service Integration with EDW: Supplement 1, Section 2.4 and Section 3.0, as applicable.	10	0	2	5	7
Initial Work Breakdown Structure for JFS Enterprise Initiative: Supplement 1, Section 2.4 and section 3.0, as applicable.	5	0	2	5	7
Initial Work Breakdown Structure for Medical Provider Management: Supplement 1, Section 2.9 and Section 3.0, as applicable.	5	0	2	5	7
Identity Management and Enterprise MDM integration: Supplement 1, Section 2.4 and Section 3.0, as applicable.	5	0	2	5	7
Business and Operations Services Plan: Supplement, Section 2.8 and Supplement 3.	10	0	2	5	7
Data Quality Execution: Supplement 1, Section 2.9	5	0	2	5	7
Project Delivery, Management, Methodology and Approach: Supplement 1, Sections 4.0 and 5.0, in their entirety.	15	0	2	5	7
Project Completion, Knowledge Transfer, Documentation, Post-Implementation Review and System Transition: Supplement 1, Section 4.2, Section 5.2 and Section 6.0.	5	0	2	5	7
Project Staffing Requirements and Use of State Staff: Including the completeness of the overall solution, plan project in delivery of the solution and use of State Resources in the successful delivery of the Enterprise MDM (in general) and each Enterprise MDM Project (specifically).	5	0	2	5	7
Offeror Proposed Key Personnel and Team: Supplement 1, Section 3.1, in its entirety.	5	0	2	5	7
Offeror's Commitment to State's Performance Measures and Service Levels: Supplements 1.0 and 2.0.	5	0	2	5	7
Affidavtance to State Architecture and Computing Standards, Security and Privacy, IT Competing and Data Handling	5	0	2	5	7

Scored Requirements	Weight	Does Not Meet	Partially Meets	Meets	Exceeds
Program Requirement: The Offeror, or subcontractor, should have at least one (1) successful experience working with a Public Federal, State, or Local Government Agency, Institution of Higher Education, Fortune 500 Company, or other organization to define and execute on a Data Management Strategy, cut the last forty-eight (48) months as indicated in Supplement 1, Section 2.1.	5	0	2	5	7
Model Architecture and Data Privacy: Supplement 1, Section 2.2 and Supplement 2, Section 3.0	5	0	2	5	7
Solution and Implementation Plan: Ohio Business expansion and Network Upgrade; Supplement 1, Section 2.3 and Section 3.0, as applicable	15	0	2	5	7
Integration and Implementation Plan - Enterprise MDM Service Integration with EDW: Supplement 1, Section 2.4 and Section 3.0, as applicable	10	0	2	5	7
Initial Work Breakdown Structure for JPS Enterprise Initiative: Supplement 1, Section 2.5	5	0	2	5	7
Initial Work Breakdown Structure for Medicaid Provider Management: Supplement 1, Section 2.6 and Section 3.0, as applicable	5	0	2	5	7
Data Management and Enterprise MDM integration: Supplement 1, Section 2.7	5	0	2	5	7
Maintenance and Operations Services Plan: Supplement, Section 2.8	10	0	2	5	7
Initial Quality Escalation: Supplement 1, Section 2.9	5	0	2	5	7
Project Delivery, Management, Methodology and Approach: Supplement 1, Sections 4.0 and 5.0, in their entirety	15	0	2	5	7
Project Completion, Knowledge Transfer, Documentation, Post-Implementation and Production Support/Transition: Supplement 1, Sections 4.2 and 5.2, in their entirety	15	0	2	5	7
Project Staffing Requirements and Use of State Staff: Including the completeness of the overall solution, project plan in delivery of the proposed solution and use of State Resources in the successful delivery of the proposed solution. DO NOT General and Specific Experience (GSE). Project specifically.	5	0	2	5	7
Offeror Proposed Key Personnel and Team: Supplement 1, Section 4.3, in their entirety	5	0	2	5	7
Adherence to State's Performance Measures and Service Levels: Supplement 1, Section 4.4	5	0	2	5	7
Adherence to State's Architecture and Computing Standards, Security Protocols, e-Commerce and Data Handling	5	0	2	5	7

a

b

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Scored Requirements	Weight	Does Not Meet	Partially Meets	Meets	Exceeds
Measurable Performance: The Offeror, co-respondent, should have at least one (1) successful experience with assessing a Public, Federal, State, Local, or Education Agency, Institution, or Entity under Section 504 of the Small Business Job Protection Act of 1996 to determine and/or execute on one or more of the following:	5	0	2	5	7
Management Strategy items will add forty-eight (48) months as indicated.					
PMI Solution Architecture and Data Privacy: Supplement 1, Section 2B and Supplement 2, Section 3.0.	10	0	2	5	7
Solution and Implementation Plan: Ohio Benefits expansion and hardware upgrade; Supplement 1, Section 2.3 and Section 3.0, as applicable.	15	0	2	5	7
Solution and Implementation Plan - Enterprise MDM Service Integration with EDW: Supplement 1, Section 2.4 and Section 3.0, as applicable.	10	0	2	5	7
Initial Work Breakdown Structure for JFS Enterprise Initiative: Supplement 1, Section 2.4 and section 3.0, as applicable.	5	0	2	5	7
Initial Work Breakdown Structure for Medicaid Provider Management: Supplement 1, Section 2.6 and Section 3.0, as applicable.	5	0	2	5	7
Identity Management and Enterprise NIDM integration: Supplement 1, Section 2.7.	5	0	2	5	7
Maintenance and Operations Services Plan: Supplement 2.8 and Supplement 3.	10	0	2	5	7
Data Quality Execution: Supplement 1, Section 2.9.	5	0	2	5	7
Project Delivery, Management, Methodology and Approach: Supplement 1, Sections 4.0 and 5.0, in their entirety.	15	0	2	5	7
Project Completion, Knowledge Transfer, Documentation, Post-Implementation Review, and Project Handoff: Supplement 1, Section 4.22, Section 4.23 and Supplement 3.	5	0	2	5	7
Project Staffing Requirements and Use of State Staff: Including the completeness of the overall solution, project plan in delivery of the solution, and the ability to support the post-implementation delivery of the Enterprise MDM Solution (in general) and each Enterprise MDM project (specifically).	5	0	2	5	7
Programmatic Key Personnel and Team: Supplement 1, Section 3.1, in its entirety.	5	0	2	5	7
Affidavits to State's Performance Measures and Service Levels: Supplement 4.	5	0	2	5	7
Security and Privacy: Architecture and Computing Standards, Security and Privacy, ICD-compliant and Data Handling.	5	0	2	5	7

Scored Requirements	Weight	Does Not Meet	Partially Meets	Meets	Exceeds
Offering Requirement: The Offeror, or subcontractor, should have at least one (1) successful experience with assisting a Public, Federal, State, and/or Government Agency, Institution of Higher Education, or Fortune 500 Company in the delivery of a MDM System, including a Data Governance and Management Strategy within the last forty-eight (48) months from the date of proposal submission.	5	0	2	5	7
MDM Solution Architecture and Data Privacy: Supplement 1, Section 2B and Supplement 2, Section 4.0.	10	0	2	5	7
Solution and Implementation Plan: Ohio Benefits expansion and hardware upgrade: Supplement 1, Section 2.3 and Section 3.0, as applicable.	15	0	2	5	7
Solution and Implementation Plan - Enterprise MDM Service Integration with EDW: Supplement 1, Section 2.4 and Section 3.0, as applicable.	10	0	2	5	7
Initial Work Breakdown Structure for JFS Enterprise Initiative: Supplement 1, Section 2.4 and Section 3.0, as applicable.	5	0	2	5	7
Initial Work Breakdown Structure for Medicaid Provider Management: Supplement 1, Section 2.6 and Section 3.0, as applicable.	5	0	2	5	7
Health Management and Enterprise MDM integration: Supplement 1, Section 2.7.	5	0	2	5	7
Maintenance and Operations Services Plan: Supplement, Section 2-B and Supplement 3.	10	0	2	5	7
Data Quality Execution: Supplement 1, Section 2.9.	5	0	2	5	7
Project Delivery, Management, Methodology and Approach: Supplement 1, Sections 4.0 and 5.0, in their entirety.	15	0	2	5	7
Project Completion, Knowledge Transfer, Documentation, Post-Implementation Review, and Project Closeout: Supplement 1, Section 4.22, Section 4.23 and Supplement 3.	5	0	2	5	7
Project Staffing Requirements and Use of State Staff: Including the completeness of the overall solution, project plan in delivery of the solution, and the staffing requirements for the delivery of the Enterprise MDM Solution (in general) and each Enterprise MDM Solution (in detail).	5	0	2	5	7
Offeror Proposed Key Personnel and Team: Supplement 1, Section 4.1, in its entirety.	5	0	2	5	7
Adherence to State's Performance Measures and Service Levels:	5	0	2	5	7
Information Security and Computing Standards, Security and Privacy IT Consulting and Data Handling:	5	0	2	5	7

Scored Requirements	Weight	Does Not Meet	Partially Meets	Meets	Exceeds
Offeror Requirement: The Offeror, or subcontractor, should have at least one (1) successful experience with assisting a Public, Federal, State, Local Government Agency, Institute of Higher Education, Fortune 500 Company, or other organization in developing a Data Management Strategy within the last forty-eight (48) months as indicated.	5	0	2	5	7
HIM Solution Architecture and Data Privacy: Supplement 1, Section 2.2 and Supplement 2, Section 3.0.	10	0	2	5	7
Solution and Implementation Plan - Ohio Business expansion and hardware upgrade: Supplement 1, Section 2.3 and Section 3.0, as applicable.	15	0	2	5	7
Solution and Implementation Plan - Enterprise MDM Service Integration with EDW: Supplement 1, Section 2.4 and Section 3.0, as applicable.	10	0	2	5	7
Initial Work Breakdown Structure for JFIS Enterprise Initiative: Supplement 1, Section 2.4 and section 3.0, as applicable.	5	0	2	5	7
Initial Work Breakdown Structure for Medicaid Provider Management: Supplement 1, Section 2.6 and Section 3.0, as applicable.	5	0	2	5	7
Identity Management and Enterprise MDM Integration: Supplement 1, Section 2.7.	5	0	2	5	7
Maintenance and Operations Services Plan: Supplement 1, Section 2.8 and Supplement 3.	10	0	2	5	7
Data Quality Execution: Supplement 1, Section 2.9.	5	0	2	5	7
Project Delivery, Management, Methodology and Approach: Supplement 1, Sections 4.0 and 5.0, in their entirety.	15	0	2	5	7
Project Completion, Knowledge Transfer, Documentation, Post-Implementation Review, and Project Transition: Supplement 1, Section 4.22, Section 4.23 and Supplement 3.	5	0	2	5	7
Project Staffing Requirements and Use of State Staff: Including the completeness of the overall proposal, project plan, delivery of the required services and support, and in the timely delivery of the Enterprise MDM Solution (in general) and each Enterprise MDM Solution (in detail).	5	0	2	5	7
Offeror Proposed Key Personnel and Team: Supplement 1, Section 5.1, in its entirety.	5	0	2	5	7
Acknowledgment to State's Performance Measures and Service Levels:	5	0	2	5	7
Authenticity to Samm's Architecture and Computing Standards, Security and Privacy Compliance and Data Handling:	5	0	2	5	7

1

8

1

Figure 6. Illustrates visual results of TableBank. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

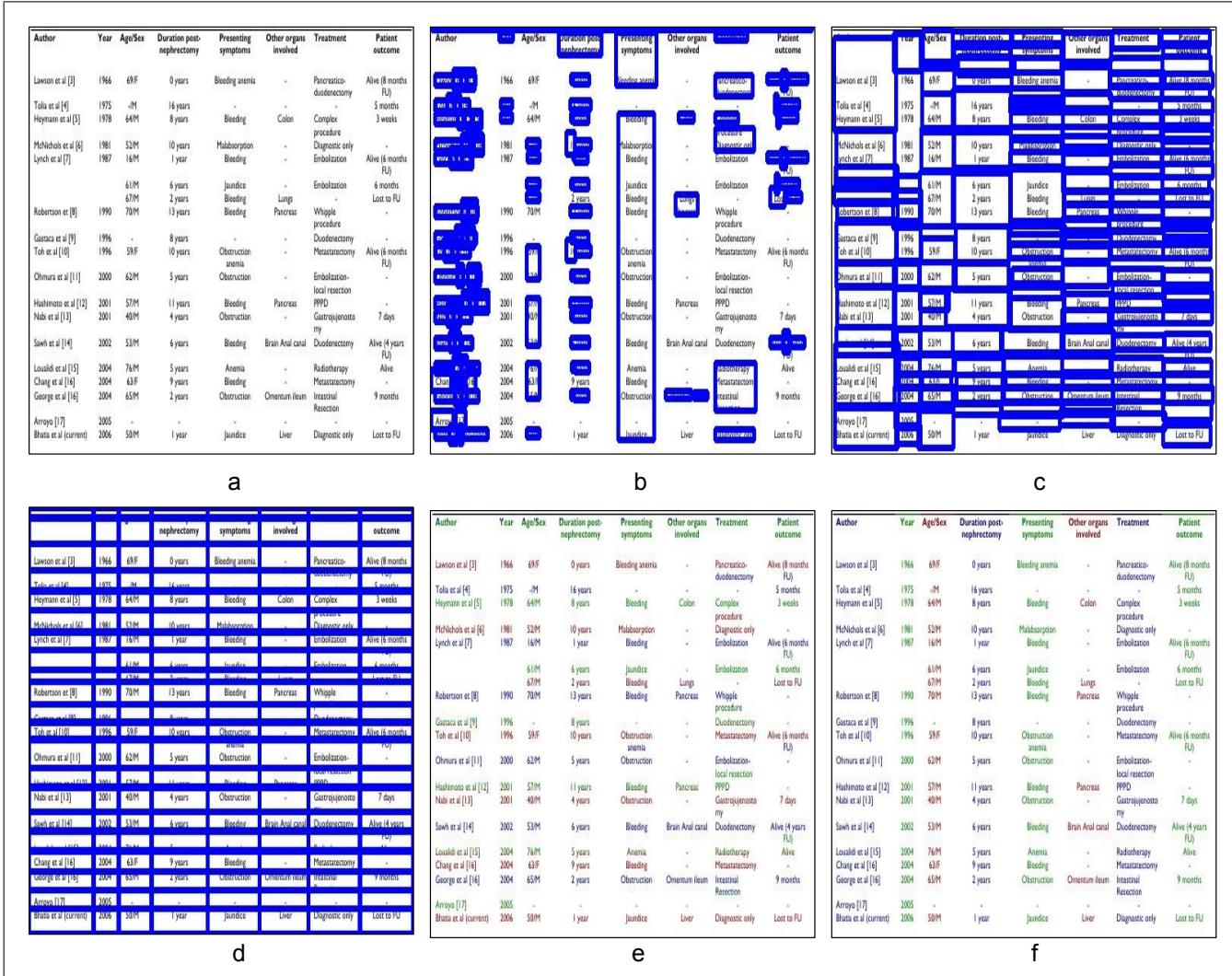


Figure 7. Illustrates visual results of PubTabNet. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

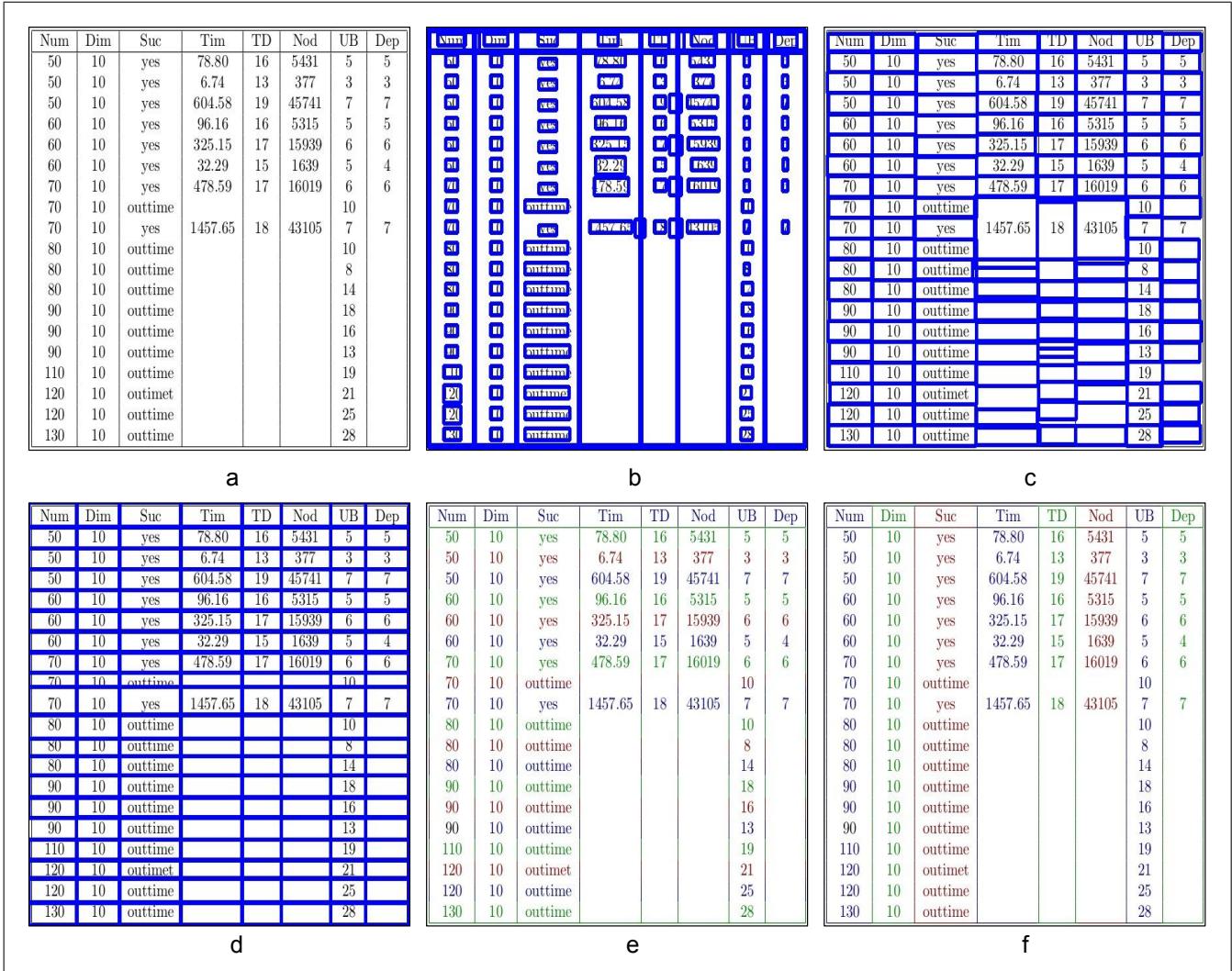


Figure 8. Illustrates visual results of SciTSR. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

Zinüberblick			
In €	2013	2012	2011
Zins und ähnliche Erlöge:			
Von zinslichen Einkünften bei Kreditinstituten	759	928	764
Festzinsen aus überlieferten Zinssicherheiten und als Wertpapierumschreibungen (Revenue Regul)	412	702	877
Festzinsen aus Wertpapieren ¹	-375	-519	-368
Zinserlöse aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	1.312	1.448	925
Dienstleistungserlöse aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	81	141	148
Festzinsen aus dem Kreditgeschäft	11.941	13.658	14.914
Schulde	741	986	1.579
Zins und ähnliche Erlöge in Prozent aus nicht zum Zinsel zu bewerteten			
finanzielle Verpflichtungen	14.873	17.404	18.890
Zum beschleunigten Zinsel zu bewertete finanzielle Vermögenswerte	10.729	14.188	15.378
Zins und ähnliche Erlöse Prozent¹	25.881	31.509	34.368
Zinsaufwendungen:			
Von zinslichen Einkünften ¹	3.385	4.946	5.958
Von zinslichen Einkünften aus überlieferten Zinssicherheiten und als Wertpapierumschreibungen (Regul)	186	315	426
Von zinslichen Einkünften aus Wertpapieren ¹	-216	-301	-169
Schulde kurzfristige Geldantritte	216	342	479
Langfristige Verbindlichkeiten ¹	1.368	2.898	2.656
Hypothek Kapitalrücknahme	846	842	813
Schulde	200	140	243
Zinsaufwendungen in Prozent aus nicht zum Zinsel zu bewerteten			
finanzielle Verpflichtungen	8.323	8.871	10.408
Zum beschleunigten Zinsel zu bewertete finanzielle Verpflichtungen	4.235	6.648	8.515
Zinsaufwendungen Prozent¹	10.708	15.619	18.921
Zinsaufwendungen	14.834	15.975	17.445

¹ Vorbehaupte waren angelegt. Hierzu verweisen wir auf die Anhangspflege 1 „Wesentliche Rechnungslegungsprinzipien und -abschätzungen“ in diesem

Zinüberblick			
In €	2013	2012	2011
Zins und ähnliche Erlöge:			
Von zinslichen Einkünften bei Kreditinstituten	759	928	764
Festzinsen aus überlieferten Zinssicherheiten und als Wertpapierumschreibungen (Revenue Regul)	412	702	877
Festzinsen aus Wertpapieren ¹	-375	-519	-368
Zinserlöse aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	1.312	1.448	925
Dienstleistungserlöse aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	81	141	148
Festzinsen aus dem Kreditgeschäft	11.941	13.658	14.914
Schulde	741	986	1.579
Zins und ähnliche Erlöge in Prozent aus nicht zum Zinsel zu bewerteten			
finanzielle Verpflichtungen	14.873	17.404	18.890
Zum beschleunigten Zinsel zu bewertete finanzielle Vermögenswerte	10.729	14.188	15.378
Zins und ähnliche Erlöse Prozent¹	25.881	31.509	34.368
Zinsaufwendungen:			
Von zinslichen Einkünften ¹	3.385	4.946	5.958
Von zinslichen Einkünften aus überlieferten Zinssicherheiten und als Wertpapierumschreibungen (Regul)	186	315	426
Von zinslichen Einkünften aus Wertpapieren ¹	-216	-301	-169
Schulde kurzfristige Geldantritte	216	342	479
Langfristige Verbindlichkeiten ¹	1.368	2.898	2.656
Hypothek Kapitalrücknahme	846	842	813
Schulde	200	140	243
Zinsaufwendungen in Prozent aus nicht zum Zinsel zu bewerteten			
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¹ Vorbehaupte waren angelegt. Hierzu verweisen wir auf die Anhangspflege 1 „Wesentliche Rechnungslegungsprinzipien und -abschätzungen“ in diesem

Zinüberblick			
In €	2013	2012	2011
Zins und ähnliche Erlöge:			
Von zinslichen Einkünften bei Kreditinstituten	759	928	764
Festzinsen aus überlieferten Zinssicherheiten und als Wertpapierumschreibungen (Revenue Regul)	412	702	877
Festzinsen aus Wertpapieren ¹	-375	-519	-368
Zinserlöse aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	1.312	1.448	925
Dienstleistungserlöse aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	81	141	148
Festzinsen aus dem Kreditgeschäft	11.941	13.658	14.914
Schulde	741	986	1.579
Zins und ähnliche Erlöge in Prozent aus nicht zum Zinsel zu bewerteten			
finanzielle Verpflichtungen	14.873	17.404	18.890
Zum beschleunigten Zinsel zu bewertete finanzielle Vermögenswerte	10.729	14.188	15.378
Zins und ähnliche Erlöse Prozent¹	25.881	31.509	34.368
Zinsaufwendungen:			
Von zinslichen Einkünften ¹	3.385	4.946	5.958
Von zinslichen Einkünften aus überlieferten Zinssicherheiten und als Wertpapierumschreibungen (Regul)	186	315	426
Von zinslichen Einkünften aus Wertpapieren ¹	-216	-301	-169
Schulde kurzfristige Geldantritte	216	342	479
Langfristige Verbindlichkeiten ¹	1.368	2.898	2.656
Hypothek Kapitalrücknahme	846	842	813
Schulde	200	140	243
Zinsaufwendungen in Prozent aus nicht zum Zinsel zu bewerteten			
finanzielle Verpflichtungen	8.323	8.871	10.408
Zum beschleunigten Zinsel zu bewertete finanzielle Verpflichtungen	4.235	6.648	8.515
Zinsaufwendungen Prozent¹	10.708	15.619	18.921
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¹ Vorbehaupte waren angelegt. Hierzu verweisen wir auf die Anhangspflege 1 „Wesentliche Rechnungslegungsprinzipien und -abschätzungen“ in diesem

Zinüberblick			
In €	2013	2012	2011
Zins und ähnliche Erlöge:			
Von zinslichen Einkünften bei Kreditinstituten	759	928	764
Festzinsen aus überlieferten Zinssicherheiten und als Wertpapierumschreibungen (Revenue Regul)	412	702	877
Festzinsen aus Wertpapieren ¹	-375	-519	-368
Zinserlöse aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	1.312	1.448	925
Dienstleistungserlöse aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	81	141	148
Festzinsen aus dem Kreditgeschäft	11.941	13.658	14.914
Schulde	741	986	1.579
Zins und ähnliche Erlöge in Prozent aus nicht zum Zinsel zu bewerteten			
finanzielle Verpflichtungen	14.873	17.404	18.890
Zum beschleunigten Zinsel zu bewertete finanzielle Vermögenswerte	10.729	14.188	15.378
Zins und ähnliche Erlöse Prozent¹	25.881	31.509	34.368
Zinsaufwendungen:			
Von zinslichen Einkünften ¹	3.385	4.946	5.958
Von zinslichen Einkünften aus überlieferten Zinssicherheiten und als Wertpapierumschreibungen (Regul)	186	315	426
Von zinslichen Einkünften aus Wertpapieren ¹	-216	-301	-169
Schulde kurzfristige Geldantritte	216	342	479
Langfristige Verbindlichkeiten ¹	1.368	2.898	2.656
Hypothek Kapitalrücknahme	846	842	813
Schulde	200	140	243
Zinsaufwendungen in Prozent aus nicht zum Zinsel zu bewerteten			
finanzielle Verpflichtungen	8.323	8.871	10.408
Zum beschleunigten Zinsel zu bewertete finanzielle Verpflichtungen	4.235	6.648	8.515
Zinsaufwendungen Prozent¹	10.708	15.619	18.921
Zinsaufwendungen	14.834	15.975	17.445

¹ Vorbehaupte waren angelegt. Hierzu verweisen wir auf die Anhangspflege 1 „Wesentliche Rechnungslegungsprinzipien und -abschätzungen“ in diesem

Figure 9. Illustrates visual results of TUCD. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

Pipeline Company	Origin	Destination	Diameter (inches)	Length (miles)	Ownership Interest	Operated by MPL
Crude oil pipeline companies:						
Bakken Pipeline system	Bakken/Three Forks area, North Dakota	Nederland, TX	30"	1,921	9.2%	No
Illinois Extension Pipeline Company LLC	Flanagan, IL	Patoka, IL	24"	168	35%	No
LOCAP LLC	Clovelly, LA	St. James, LA	48"	57	59%	No
LOOP LLC (LOOP) ⁽ⁱ⁾	Offshore Gulf of Clovelly, LA	Mexico	48"	48	41%	No
Total				<u>2,194</u>		
Products pipeline companies:						
Explorer Pipeline Company	Port Arthur, TX	Hammond, IN	12"-28"	1,830	25%	No
Louisville, KY to Lexington, KY ^(j)	Louisville, KY	Lexington, KY	8"	87	65%	Yes
				<u>1,917</u>		

a

Pipeline Company	Origin	Destination	Diameter (inches)	Length (miles)	Ownership Interest	Operated by MPL
Crude oil pipeline companies:						
Bakken Pipeline system	Bakken/Three Forks area, North Dakota	Nederland, TX	30"	1,921	9.2%	No
Illinois Extension Pipeline Company LLC	Flanagan, IL	Patoka, IL	24"	168	35%	No
LOCAP LLC	Clovelly, LA	St. James, LA	48"	57	59%	No
LOOP LLC (LOOP) ⁽ⁱ⁾	Offshore Gulf of Clovelly, LA	Mexico	48"	48	41%	No
Total				<u>2,194</u>		
Products pipeline companies:						
Explorer Pipeline Company	Port Arthur, TX	Hammond, IN	12"-28"	1,830	25%	No
Louisville, KY to Lexington, KY ^(j)	Louisville, KY	Lexington, KY	8"	87	65%	Yes
				<u>1,917</u>		

b

Pipeline Company	Origin	Destination	Diameter (inches)	Length (miles)	Ownership Interest	Operated by MPL
Crude oil pipeline companies:						
Bakken Pipeline system	Bakken/Three Forks area, North Dakota	Nederland, TX	30"	1,921	9.2%	No
Illinois Extension Pipeline Company LLC	Flanagan, IL	Patoka, IL	24"	168	35%	No
LOCAP LLC	Clovelly, LA	St. James, LA	48"	57	59%	No
LOOP LLC (LOOP) ⁽ⁱ⁾	Offshore Gulf of Clovelly, LA	Mexico	48"	48	41%	No
Total				<u>2,194</u>		
Products pipeline companies:						
Explorer Pipeline Company	Port Arthur, TX	Hammond, IN	12"-28"	1,830	25%	No
Louisville, KY to Lexington, KY ^(j)	Louisville, KY	Lexington, KY	8"	87	65%	Yes
				<u>1,917</u>		

c

Pipeline Company	Origin	Destination	Diameter (inches)	Length (miles)	Ownership Interest	Operated by MPL
Crude oil pipeline companies:						
Bakken Pipeline system	Bakken/Three Forks area, North Dakota	Nederland, TX	30"	1,921	9.2%	No
Illinois Extension Pipeline Company LLC	Flanagan, IL	Patoka, IL	24"	168	35%	No
LOCAP LLC	Clovelly, LA	St. James, LA	48"	57	59%	No
LOOP LLC (LOOP) ⁽ⁱ⁾	Offshore Gulf of Clovelly, LA	Mexico	48"	48	41%	No
Total				<u>2,194</u>		
Products pipeline companies:						
Explorer Pipeline Company	Port Arthur, TX	Hammond, IN	12"-28"	1,830	25%	No
Louisville, KY to Lexington, KY ^(j)	Louisville, KY	Lexington, KY	8"	87	65%	Yes
				<u>1,917</u>		

d

Pipeline Company	Origin	Destination	Diameter (inches)	Length (miles)	Ownership Interest	Operated by MPL
Crude oil pipeline companies:						
Bakken Pipeline system	Bakken/Three Forks area, North Dakota	Nederland, TX	30"	1,921	9.2%	No
Illinois Extension Pipeline Company LLC	Flanagan, IL	Patoka, IL	24"	168	35%	No
LOCAP LLC	Clovelly, LA	St. James, LA	48"	57	59%	No
LOOP LLC (LOOP) ⁽ⁱ⁾	Offshore Gulf of Clovelly, LA	Mexico	48"	48	41%	No
Total				<u>2,194</u>		
Products pipeline companies:						
Explorer Pipeline Company	Port Arthur, TX	Hammond, IN	12"-28"	1,830	25%	No
Louisville, KY to Lexington, KY ^(j)	Louisville, KY	Lexington, KY	8"	87	65%	Yes
				<u>1,917</u>		

e

Pipeline Company	Origin	Destination	Diameter (inches)	Length (miles)	Ownership Interest	Operated by MPL
Crude oil pipeline companies:						
Bakken Pipeline system	Bakken/Three Forks area, North Dakota	Nederland, TX	30"	1,921	9.2%	No
Illinois Extension Pipeline Company LLC	Flanagan, IL	Patoka, IL	24"	168	35%	No
LOCAP LLC	Clovelly, LA	St. James, LA	48"	57	59%	No
LOOP LLC (LOOP) ⁽ⁱ⁾	Offshore Gulf of Clovelly, LA	Mexico	48"	48	41%	No
Total				<u>2,194</u>		
Products pipeline companies:						
Explorer Pipeline Company	Port Arthur, TX	Hammond, IN	12"-28"	1,830	25%	No
Louisville, KY to Lexington, KY ^(j)	Louisville, KY	Lexington, KY	8"	87	65%	Yes
				<u>1,917</u>		

f

Figure 10. Illustrates visual results of FinTabNet. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

Corporate Stockholders' Equity							
	Preferred Capital in Excess of Par Value	Treasury Stock	Retained Earnings	Accumulated Other Comprehensive Income (Loss)	Noncontrolling Interest in Consolidated Subsidiaries		Total
Millions of dollars	Common Shares						
Balances at December 31, 2006	\$ 2,658	\$ 1,689	\$ (1,277)	\$ 5,031	\$ (457)	\$ 95	\$ 7,945
Adoption of new accounting standard	—	63	—	(43)	—	—	20
Adjusted Balance at December 31, 2006	\$ 2,658	\$ 1,752	\$ (1,277)	\$ 5,086	\$ (457)	\$ 69	\$ 7,945
Capital dividends paid	7	23	130	(314)	—	—	160
Common shares purchased	—	—	(1,274)	—	—	—	(1,274)
Exercise of stock options	—	—	—	—	—	—	—
Tax benefit from exercise of options	—	—	—	—	—	—	—
Redemption of restricted stock	—	29	—	—	—	—	29
Distribution to exercising interest holders	—	—	—	—	(5)	(5)	—
Other transfers with shareholders	—	—	(4)	—	(21)	(25)	—
Dividends and other transactions with shareholders	7	52	(1,244)	(315)	—	(26)	(1,529)
Stock issued in EUR 100 exchange offer	—	—	(1,089)	—	—	—	(1,089)
Adoption of new accounting standard	—	—	(30)	—	—	—	(30)
Comprehensive income (loss):	—	—	—	—	—	—	—
Net income	—	—	—	3,486	—	50	3,536
Less comprehensive income (loss):	—	—	—	—	—	—	—
Cumulative translation adjustment	—	—	—	—	1	—	1
Realization of translation gain included in net assets of foreign operations	—	—	—	—	—	—	—
Defined benefit and other postretirement plan adjustments:	—	—	—	—	(24)	—	(24)
Prior service credit	—	—	—	—	(2)	—	(2)
Plan assets	—	—	—	—	5	—	5
Settlements/curtailments	—	—	—	—	—	—	—
Actuarial gain (loss):	—	—	—	—	105	—	105
Net gain	—	—	—	—	14	—	14
Amortization of net loss	—	—	—	—	7	—	7
Settlements/curtailments	—	—	—	—	—	—	—
Tax effect on defined benefit and other postretirement plan	—	—	—	(45)	—	(45)	—
KSE, Inc. separation	—	—	271	—	—	271	—
Defined benefit and other postretirement plans, net	—	—	—	355	—	—	355
Minimum plan guarantees, net	—	—	—	—	1	—	1
Net comprehensive income	—	—	—	3,486	333	50	3,869
Total Comprehensive Income	\$ 2,657	\$ 1,804	\$ 51,670	\$ 8,146	\$ 1,060	\$ 95	\$ 74,996
Balances at December 31, 2007	\$ 2,657	\$ 1,804	\$ 51,670	\$ 8,146	\$ 1,060	\$ 95	\$ 74,996

a

b

	Corporate Overview - 2006			
	Balances	Capital in Excess of Par	Treasury Stock	Retained Earnings
Millions of dollars				
Balance at December 31, 2006	\$ 2,655	\$ 1,689	\$ (1,577)	\$ 505
Adoption of new accounting standard		63		(43)
Adjusted Balance at December 31, 2006	\$ 2,650	\$ 1,752	\$ (1,577)	\$ 508
Dividends paid:				
Common stock	—	—	21	(186)
Preferred stock	—	—	—	(34)
Common shares purchased	—	—	—	(1,374)
Total benefit from exercise of options and restricted stock	—	29	—	—
Other nonvested equity instruments held by non-employees	—	—	—	(5)
Other transactions with shareholders	—	—	—	(4)
Total dividends and other transactions with shareholders	—	29	—	(21)
Total dividends and other transactions with shareholders	32	1,781	(1,577)	(26)
Conversion of ESR, Inc. exchange offer	—	—	(\$899)	—
Adoption of new accounting standard			—	(30)
Comprehensive income (loss):				
Net income	—	—	—	50
Other comprehensive income (loss):	—	—	—	3.5
Cumulative translation adjustment	—	—	—	—
Realization of translation gains included in net assets	—	—	—	—
Defined benefit and other postretirement plans:				
Plan assets:				
Plan service cost	—	—	—	—
Plan assets	—	—	—	(2)
Settlements/earnings	—	—	—	—
Actuarial gain/loss	—	—	—	—
Net of amortization of net loss	—	—	—	105
Settlements/earnings	—	—	—	(10)
Tax effect on defined benefit and postretirement plans	—	—	—	(45)
KSE	—	—	—	237
Defined benefit and other postretirement plans, net	—	—	—	355
Net amount of plan assets, net	—	—	—	1
Net amount of plan assets, net	—	—	—	1
Total comprehensive income	—	—	—	—
Balance at December 31, 2007	\$ 2,657	\$ 1,804	\$ (1,620)	\$ 514
Accumulated Other Comprehensive Income				
Noncontrolling interest in consolidated subsidiary	—	—	—	—
Total	\$ 69	\$ 69	\$ 7.6	\$ 7.6

	Corporation Shareholders' Equity					
	Paid-in Capital	Capital Contributed	Assimilated	Noncontrolling Interest in Entity		
	Earnings		Other			
	of Par	Treasury	Retained Earnings	Comprehensive Income (Loss)		
	Shares	Value			Shareholders'	
Millions of dollars					Shareholders'	
Balances at December 31, 2006	\$ 2,650	\$ 1,489	\$ 1,257	\$ 497	\$ 65	\$ 7,945
Adjustments to account for market value changes	—	—	(101)	(101)	—	—
Adjusted Balance at December 31, 2006	\$ 2,650	\$ 1,783	\$ 1,157	\$ 508	\$ 497	\$ 7,945
Cash dividends paid	—	—	(114)	—	—	(114)
Stock purchases	7	25	(10)	—	—	(10)
Stock options and shares purchased	—	—	(1,276)	—	—	(1,276)
Exercise of exercise of options and restricted stock	—	—	—	—	—	—
Total dividends and other transactions	—	—	—	—	—	—
Transfers to noncontrolling interest added	—	—	—	—	—	—
Other transfers with shareholders	—	—	(44)	—	(44)	(44)
Total dividends and other transactions with shareholders	7	52	(1,246)	(318)	—	(26)
Shares exchanged at \$0.85, no. exchange offer	—	—	(2,809)	—	—	(2,809)
Exercise of options and stock purchases	—	—	(106)	—	—	(106)
Comprehensive (loss) income:	—	—	—	—	—	—
Net income	—	—	3,486	—	50	3,536
Accumulated other comprehensive (loss) Cumulative translation adjustment	—	—	—	—	1	1
Redeemable preference stock paid-in not in excess	—	—	—	—	(24)	(24)
Dividends and other distributions paid to shareholders	—	—	—	—	—	—
Dividends and other distributions paid to service cost	—	—	—	(2)	—	(2)
Plan amortization	—	—	—	—	—	—
Amortization of intangible assets	—	—	—	—	3	3
Acquired plan assets	—	—	—	—	—	—
Net gain	—	—	—	105	—	105
Amortization of net loss	—	—	—	14	—	14
Amortization of net gain	—	—	—	7	—	7
Fair value of defined benefit plan and investment plan	—	—	(45)	—	—	(45)
ESOP, Inc. option plan	—	—	—	271	—	271
Defined benefit and other	—	—	—	—	—	—
Unrealized gains and losses on investments, net at fair value of \$0 million	—	—	—	335	—	335
Net unrealized gain on investments, net at fair value of \$0 million	—	—	—	3,486	331	50
Balance at December 31, 2007	\$ 2,657	\$ 1,804	\$ 5,620	\$ 8,146	\$ 104	\$ 53
Total equity at December 31, 2007	—	—	—	—	—	3,869

4

Company Shareholders' Equity							
	Preferred Capital in Excess of Par Value	Treasury Stock	Retained Earnings	Accumulated Other Comprehensive Income (Loss)	Noncontrolling Interest in Consolidated Subsidiaries	Total	
Millions of dollar	Common Shares						
Balances at December 31, 2006	\$ 2,650	\$ 1,689	\$ (357)	\$ (581)	\$ (471)	\$ 69	\$ 7,442
Addition of New accounting standard	—	63	(63)	—	—	—	—
Adjustment Balance at December 31, 2006	\$ 2,650	\$ 1,752	\$ (357)	\$ 508	\$ (471)	\$ 69	\$ 7,462
Dividends paid	—	—	—	(314)	—	—	(314)
Stock repurchase	7	23	130	—	—	—	16
Stock options purchased	—	—	(1,374)	—	—	—	(1,374)
Tax benefit from exercise of options and restricted stock	—	29	—	—	—	—	29
Transfers between controlling interest holders	—	—	—	—	(5)	—	(5)
Other interactions with shareholders	—	—	—	(4)	(21)	—	(25)
Total dividends and other transactions with shareholders	7	52	(1,244)	(318)	—	(26)	(1,552)
Shares exercised under ESO, no exchange offer	—	—	(2,889)	(80)	—	—	(2,969)
Shares issued under New accounting standard	—	—	—	(80)	—	—	(80)
Comprehensive income (loss)	—	—	—	3,486	—	50	3,536
Net income	—	—	—	—	—	—	—
Comprehensive income (loss)	—	—	—	3,486	—	50	3,536
Cumulative translation adjustment	—	—	—	—	1	—	1
Realization of translation gains included in net income	—	—	—	—	1	—	1
Distributions under other postretirement plan adjustments:	—	—	—	—	(24)	—	(24)
Prize service cost:	—	—	—	—	—	—	—
Plan amendment	—	—	—	—	(2)	—	(2)
Service and interest adjustments	—	—	—	—	5	—	5
Actuarial gain (loss)	—	—	—	—	—	—	—
Net gain	—	—	—	—	105	—	105
Amortization of fair value loss	—	—	—	—	14	—	14
Settlements/contractions	—	—	—	—	7	—	7
Tax effect on defined benefit and posttermination plans	—	—	—	(45)	—	—	(45)
KRIS, Inc. acquisition	—	—	—	271	—	—	271
Distributions under other postretirement plan adjustments:	—	—	—	—	355	—	355
Net unreal gains on investments, net of tax provision (if any)	—	—	—	—	—	—	—
Total comprehensive income	\$ 2,657	\$ 1,804	\$ 55,650	\$ 3,146	\$ 3,696	355	\$ 69,606
Balance at December 31, 2007	\$ 2,657	\$ 1,804	\$ 55,650	\$ 3,146	\$ 3,696	355	\$ 69,606

6

Company shareholders' equity							
Millions of dollars	Common Shares	Capital in Excess of Par Value	Treasury Stock	Retained Earnings	Accumulated Other Comprehensive Income (Loss)	Noncontrolling Interest in Consolidated Subsidiaries	Total
Balances at December 31, 2006	\$ 2,650	\$ 1,689	\$ (1,577)	\$ 5,501	\$ (157)	\$ 69	\$ 7,460
Adoption of new accounting standard			(43)				
Adjusted balance at December 31, 2006	\$ 2,650	\$ 1,752	\$ (1,577)	\$ 5,501	\$ (157)	\$ 69	\$ 7,460
Cash dividends paid	—	—	—	(314)	—	—	(314)
Stock plan	7	23	(36)	—	—	—	10
Corporate bonds purchased	—	—	(374)	—	—	—	(374)
Termination fee from exercise of restricted stock	—	29	—	—	—	—	29
Other transaction with shareholders	—	—	—	—	(5)	(5)	—
Total dividends and other transactions with shareholders	7	52	(1,244)	(318)	—	(26)	(1,518)
Stock options exercised (B/E, no exchange offer)	—	63	—	(30)	—	—	(29)
Adoption of new accounting standard			(30)				0
Comprehensive income (loss):							
Net income	—	—	—	3,498	—	50	3,548
Other comprehensive income (loss):							
Cumulative translation adjustment	—	—	—	—	1	—	1
Translation of translate gains included in net income	—	—	—	—	(24)	—	(24)
Effect of prior period and other postperiod plan adjustments:							
Prior service cost:							
Plan amendment	—	—	—	—	(2)	—	(2)
Settlement of obligations	—	—	—	5	—	5	5
Actuarial gain (loss):							
Net gain	—	—	—	—	105	—	105
Amortization of net loss	—	—	—	14	—	14	14
Settlement variances	—	—	—	—	7	—	7
Effect on defined benefit and pension-related plan	—	—	—	—	(45)	—	(45)
KESI, Inc. separation	—	—	—	271	—	2	273
Defined benefit and other postretirement plan net assets	—	—	—	—	355	—	355
Net unrealized gain on investments, net of tax provision of \$0	—	—	—	—	1	—	1
Total comprehensive income (loss):	—	—	—	3,498	333	50	3,881
Balances at December 31, 2007	\$ 2,657	\$ 1,804	\$ (5,630)	\$ 5,146	\$ (106)	\$ 93	\$ 6,966

8

Figure 11. Illustrates visual results of FinTabNet. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

(In millions)	Pension Benefits		Other Benefits	
	2012	2011	2012	2011
Change in benefit obligations:				
Benefit obligations at January 1	\$ 2,685	\$ 2,266	\$ 551	\$ 483
Service cost	66	65	20	19
Interest cost	94	110	24	27
Actuarial loss	117	384	53	39
Benefits paid	(235)	(178)	(17)	(17)
Liability gain due to curtailment	(17)	(4)	-	-
Other ^(a)	(520)	42	(40)	-
Benefit obligations at December 31	2,192	2,685	591	551
Change in plan assets:				
Fair value of plan assets at January 1	1,423	1,233	-	-
Actual return on plan assets	157	50	-	-
Employer contributions	131	282	-	-
Other ^(a)	-	36	-	-
Benefits paid from plan assets	(233)	(178)	-	-
Fair value of plan assets at December 31	1,478	1,423	-	-
Funded status of plans at December 31	\$ (714)	\$ (1,263)	\$ (591)	\$ (551)
Amounts recognized in the consolidated balance sheets:				
Current liabilities	\$ (18)	\$ (12)	\$ (21)	\$ (18)
Noncurrent liabilities	(696)	(1,250)	(570)	(533)
Accrued benefit cost	\$ (714)	\$ (1,263)	\$ (591)	\$ (551)
Pretax amounts recognized in accumulated other comprehensive loss:^(b)				
Net loss	\$ 1,147	\$ 1,319	\$ 93	\$ 42
Prior service cost (credit)	(1,460)	42	(38)	-

	Current Element		Next Elements	
	2014	2015	2014	2015
Change in benefit obligations				
Benefit obligations at January 1	\$ 1,055	\$ 1,055	\$ 1,055	\$ 1,055
Service cost	52	52	50	50
Interest cost	15	11	16	14
Experience	19	16	17	14
Rental cost	1	1	1	1
Benefit credit	(253)	(176)	(177)	(14)
Ability gain loss in commitment	(19)	61	-	-
Share	(260)	16	(40)	-
Benefit obligations at December 31	\$ 1,029	\$ 1,055	\$ 101	\$ 1,055
Change in plan assets				
Estimated plan assets at January 1	\$ 1,265	\$ 1,243	-	-
Actual return on plan assets	57	61	-	-
Employee contributions	13	26	-	-
Share	16	-	-	-
Estimated plan assets at December 31	\$ 1,253	\$ 1,176	-	-
Plan assets less plan deficits at December 31	\$ 1,205	\$ 1,124	-	-
Defined status at December 31	\$ 1,016	\$ 1,055	\$ 1,091	\$ 1,055
Amount recognized in the consolidated balance sheet				
Current liabilities	\$ 118	\$ 123	\$ 211	\$ 1
Noncurrent liabilities	(605)	(580)	(570)	\$ 83
Accrued benefit costs	\$ 245	\$ 1,038	\$ 1,091	\$ 1,055
Precise amounts recognized in accumulated other comprehensive loss				
Net loss	\$ 143	\$ 110	\$ 13	\$ 1
Net service cost credit	(260)	16	(58)	\$ 83

(in millions)	Pension Benefits		Other Benefits	
	2012	2011	2012	2011
Change in benefit obligations:				
Benefit obligations at January 1	\$ 2,685	\$ 2,266	\$ 551	\$ 483
Service cost	66	65	20	19
Interest cost	94	110	24	27
Actuarial loss	117	384 ⁽¹⁾	53	39
Benefits paid	(235)	(178)	(17)	(17)
Liability gain due to curtailment		(17)	(4)	-
Other ⁽²⁾	(520)	42	(40)	-
Benefit obligations at December 31	2,192	2,685	591	551
Change in plan assets:				
Fair value of plan assets at January 1	1,423	1,233	-	-
Actual return on plan assets	157	50	-	-
Employer contributions	151	282	-	-
Other ⁽³⁾	-	36	-	-
Benefits paid from plan assets	(233)	(178)	-	-
Fair value of plan assets at December 31	1,478	1,423	-	-
Funded status of plans at December 31	\$ (714)	\$ (1,262)	\$ (991)	\$ (551)
Amounts recognized in the consolidated balance sheets:				
Current liabilities	\$ (18)	\$ (12)	\$ (21)	\$ (18)
Noncurrent liabilities	(696)	(1,250)	(570)	(533)
Accrued benefit cost	\$ (714)	\$ (1,262)	\$ (991)	\$ (551)
Pretax amounts recognized in accumulated other comprehensive loss:⁽⁴⁾				
Net loss	\$ 1,147	\$ 1,319	\$ 93	\$ 42
Prior service cost (credit)	(460)	42	(38)	-

a

b

0

(In millions)	Pension Benefits		Other Benefits	
	2012	2011	2012	2011
Change in benefit obligations:				
Benefit obligations at January 1	\$ 2,685	\$ 2,266	\$ 551	\$ 483
Service cost	66	65	20	19
Interest cost	94	110	24	27
Actuarial loss	117	384	53	39
Benefits paid	(233)	(178)	(17)	(17)
Liability gain due to curtailment	(17)	(4)	-	-
Other ^(a)	(520)	42	(40)	-
Benefit obligations at December 31	2,192	2,685	591	551
Change in plan assets:				
Fair value of plan assets at January 1	1,423	1,233	-	-
Actual return on plan assets	157	50	-	-
Employer contributions	131	282	-	-
Other ^(a)	-	36	-	-
Benefits paid from plan assets	(233)	(178)	-	-
Fair value of plan assets at December 31	1,478	1,423	-	-
Funded status of plans at December 31	\$ (714)	\$ (1,263)	\$ (591)	\$ (551)
Amounts recognized in the consolidated balance sheets:				
Current liabilities	\$ (18)	\$ (12)	\$ (21)	\$ (18)
Noncurrent liabilities	(696)	(1,250)	(570)	(533)
Accrued benefit cost	\$ (714)	\$ (1,263)	\$ (591)	\$ (551)
Pretax amounts recognized in accumulated other comprehensive loss:^(b)				
Net loss	\$ 1,147	\$ 1,319	\$ 93	\$ 42
Prior service cost (credit)	(460)	42	(38)	-

<i>(In millions)</i>	Pension Benefits		Other Benefits	
	2012	2011	2012	2011
Change in benefit obligations:				
Benefit obligations at January 1	\$ 2,685	\$ 2,266	\$ 551	\$ 48
Service cost	66	65	20	1
Interest cost	94	110	24	2
Actuarial loss	117	384	53	3
Benefits paid	(233)	(178)	(17)	(1)
Liability gain due to curtailment	(17)	(4)	-	(1)
Other ^(a)	(520)	42	(40)	(1)
Benefit obligations at December 31	<u>2,192</u>	<u>2,685</u>	<u>591</u>	<u>55</u>
Change in plan assets:				
Fair value of plan assets at January 1	1,423	1,233	-	-
Actual return on plan assets	157	30	-	-
Employer contributions	131	282	-	-
Other ^(a)	-	36	-	-
Benefits paid from plan assets	(233)	(178)	-	-
Fair value of plan assets at December 31	<u>1,478</u>	<u>1,423</u>	<u>-</u>	<u>-</u>
Funded status of plans at December 31	<u>\$ (714)</u>	<u>\$ (1,262)</u>	<u>\$ (591)</u>	<u>\$ (55)</u>
Amounts recognized in the consolidated balance sheets:				
Current liabilities	\$ (18)	\$ (12)	\$ (21)	\$ (1)
Noncurrent liabilities	(696)	(1,230)	(570)	(53)
Accrued benefit cost	<u>\$ (714)</u>	<u>\$ (1,262)</u>	<u>\$ (591)</u>	<u>\$ (55)</u>
Pretax amounts recognized in accumulated other comprehensive loss:^(b)				
Net loss	\$ 1,147	\$ 1,319	\$ 93	\$ 4
Prior service cost (credit)	(460)	42	(38)	(1)

(In millions)	Pension Benefits		Other Benefits	
	2012	2011	2012	2011
Change in benefit obligations:				
Benefit obligations at January 1	\$ 2,685	\$ 2,266	\$ 551	\$ 483
Service cost	66	65	20	19
Interest cost	94	110	24	27
Actuarial loss	117	384	53	39
Benefits paid	(233)	(178)	(17)	(17)
Liability gain due to curtailment	(17)	(4)	-	-
Other ^(a)	(520)	42	(40)	-
Benefit obligations at December 31	2,192	2,685	591	551
Change in plan assets:				
Fair value of plan assets at January 1	1,423	1,233	-	-
Actual return on plan assets	157	50	-	-
Employer contribution	131	282	-	-
Other ^(a)	-	36	-	-
Benefits paid from plan assets	(233)	(178)	-	-
Fair value of plan assets at December 31	1,478	1,423	-	-
Funded status of plans at December 31	<u>\$ (714)</u>	<u>\$ (1,262)</u>	<u>\$ (591)</u>	<u>\$ (551)</u>
Amounts recognized in the consolidated balance sheets:				
Current liabilities	\$ (18)	\$ (12)	\$ (21)	\$ (18)
Noncurrent liabilities	(966)	(1,250)	(570)	(570)
Accrued benefit cost	<u>\$ (714)</u>	<u>\$ (1,262)</u>	<u>\$ (591)</u>	<u>\$ (551)</u>
Pretax amounts recognized in accumulated other comprehensive loss:^(b)				
Net loss	\$ 1,147	\$ 1,319	\$ 93	\$ 42
Prior service cost (credit)	(460)	42	(38)	-

d

e

f

Figure 12. Illustrates visual results of FinTabNet. (a) original table image, (b) word detection using Tesseract, (c) cell detection using TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column adjacent using TSR-Net.

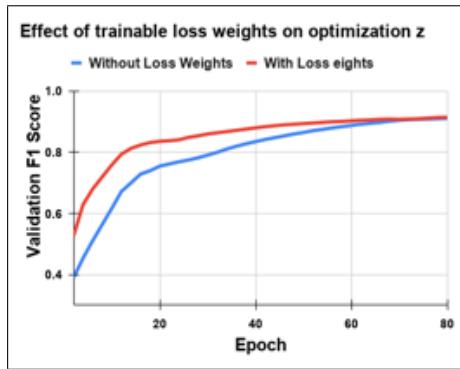


Figure 13. Shows the plot of validation accuracy against epochs. Blue line indicates scores without the use of loss weights, while red line indicates scores when trainable loss weights were used. In both the cases, same weight initialization was used.