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 others. 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 ajdacencies 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 rebustness 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

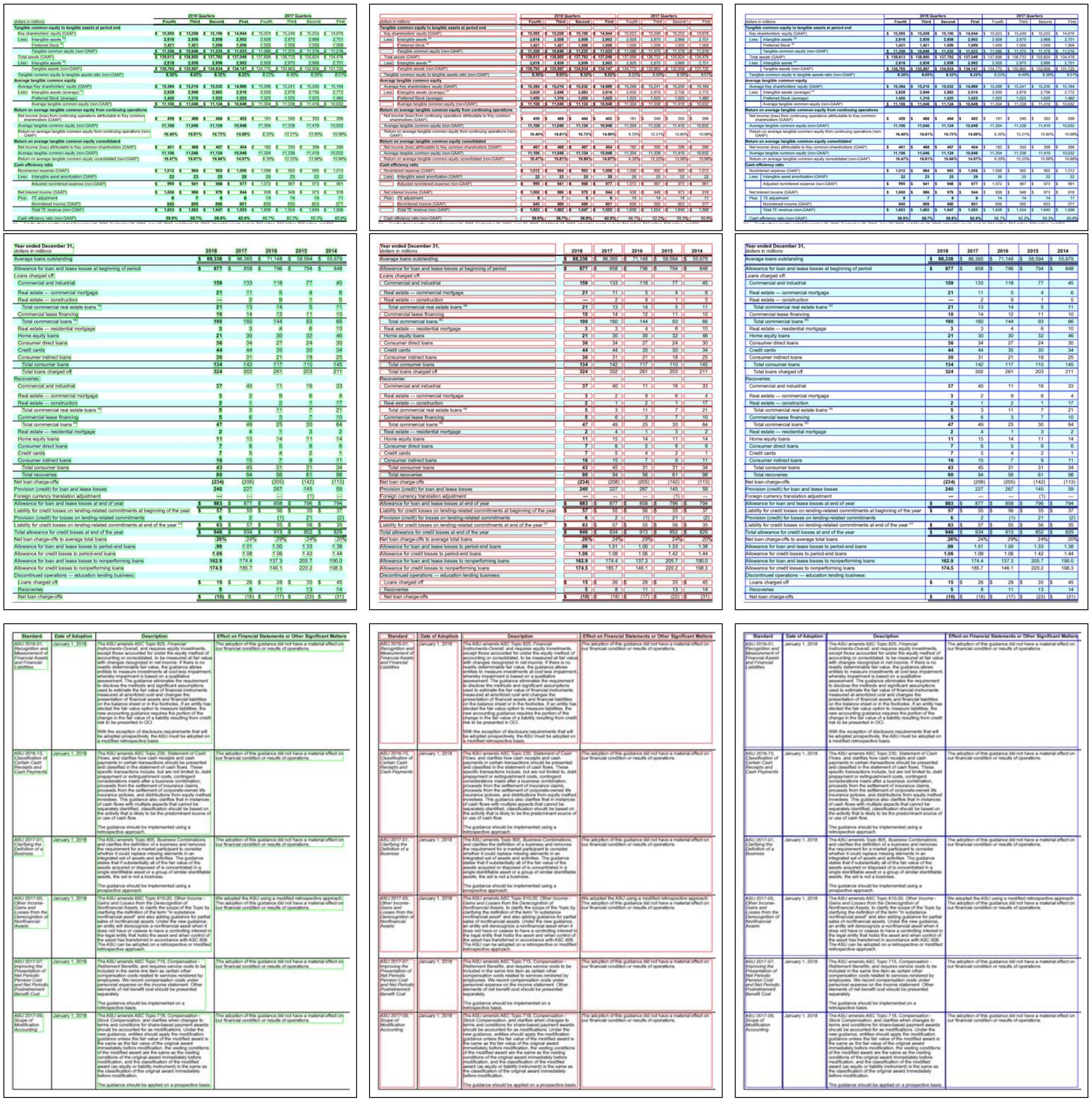
Table 2. Shows the performances of the proposed networks and its comparison against the existing techniques on logical table structure recognition in PubTabNet [40] dataset. IoU threshold is set to 0.6. **TEDS:** indicates Tree-Edit-Distance-based Similarity.

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.

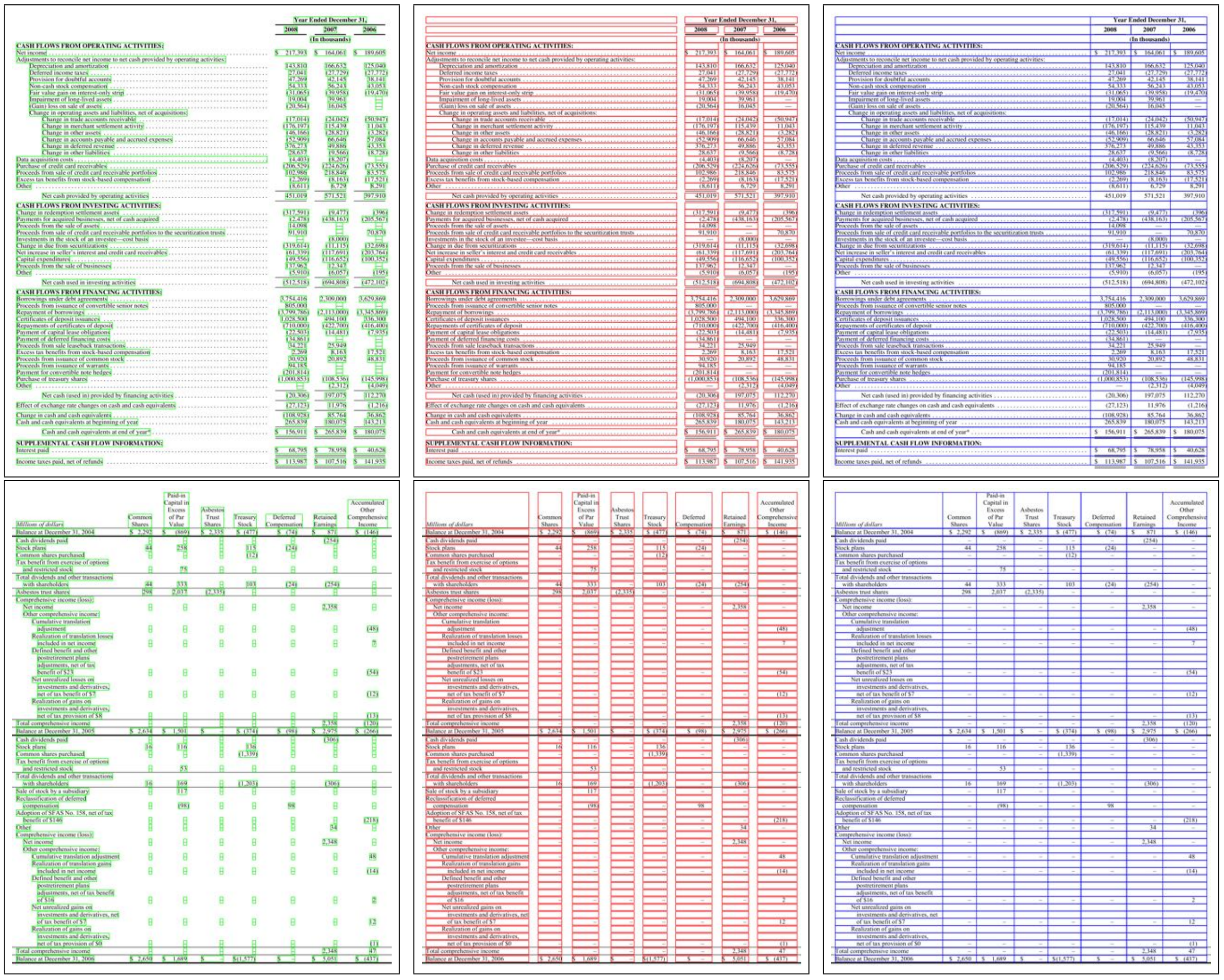
Method	**IoU**	**FinTabNet**		**ICDAR-13**		**Sci-TSR**		**TUCD**	
		CD-F1↑	**TSR-F1↑**	**CD-F1↑**	**TSR-F1↑**	**CD-F1↑**	**TSR-F1↑**	**CD-F1↑**	**TSR-F1↑**
TabStruct-Net [24]		0.911	0.898	0.922	0.904	0.899	0.876	0.916	0.90
TOD-Net† +TSR-Net+PP	0.5	0.930	0.906	0.92	0.903	0.907	0.88	0.911	0.889
TOD-Net‡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



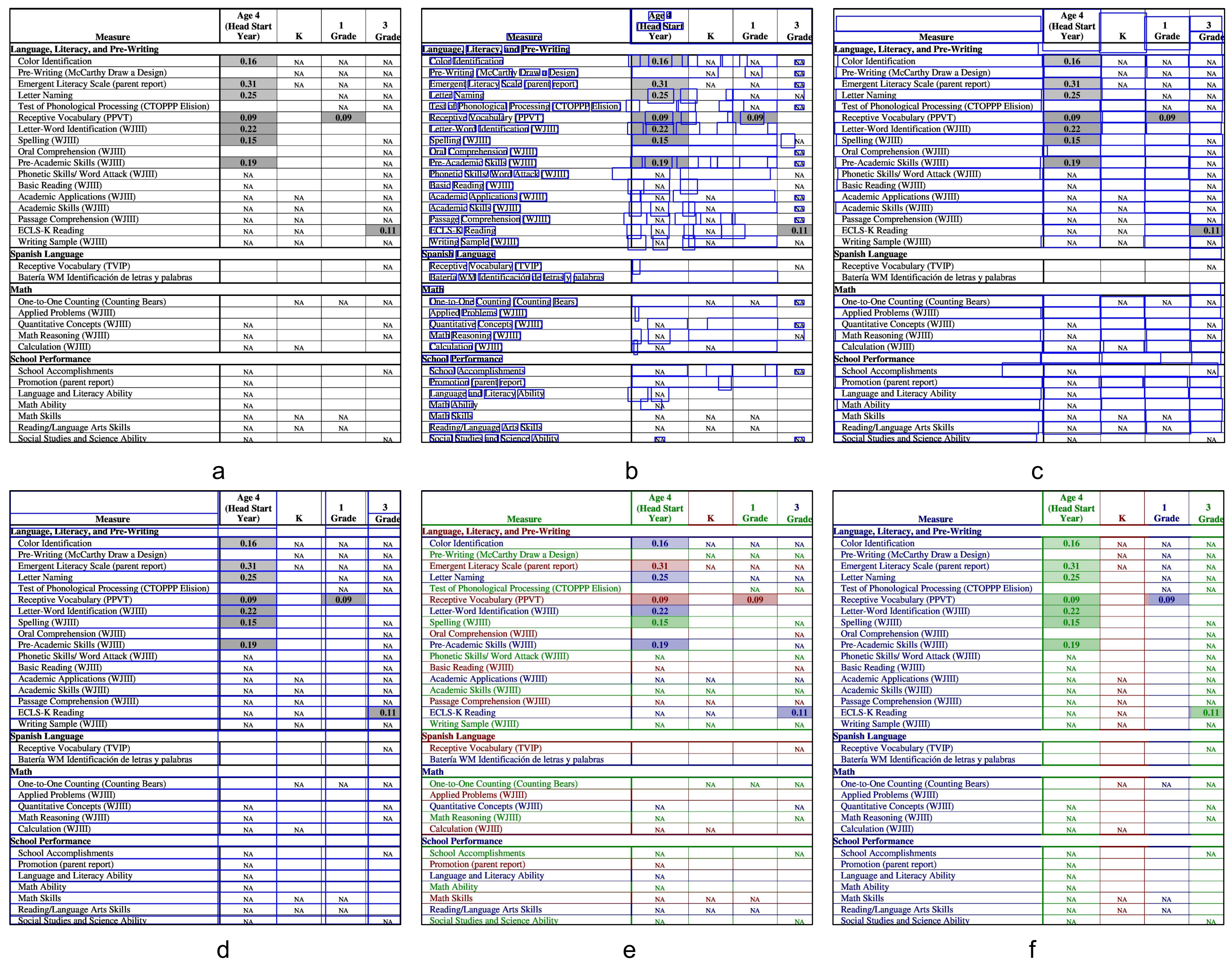
(a) (b) (c)

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.



(a) (b) (c)

Figure 2. 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.



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
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			NA
Basic Reading (WJIII)	NA			NA
Academic Applications (WJIII)	NA	NA		NA
Academic Skills (WJIII)	NA	NA		NA
Passage Comprehension (WJIII)	NA	NA		NA
ECLS-K Reading	NA	NA		**0.11**
Writing Sample (WJIII)	NA	NA		NA
Spanish Language				
Receptive Vocabulary (TVIP)				NA
Batería WM Identificación de letras y palabras				
Math				
One-to-One Counting (Counting Bears)		NA	NA	NA
Applied Problems (WJIII)				
Quantitative Concepts (WJIII)	NA			NA
Math Reasoning (WJIII)	NA			NA
Calculation (WJIII)	NA	NA		
School Performance				
School Accomplishments	NA			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 uding 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.

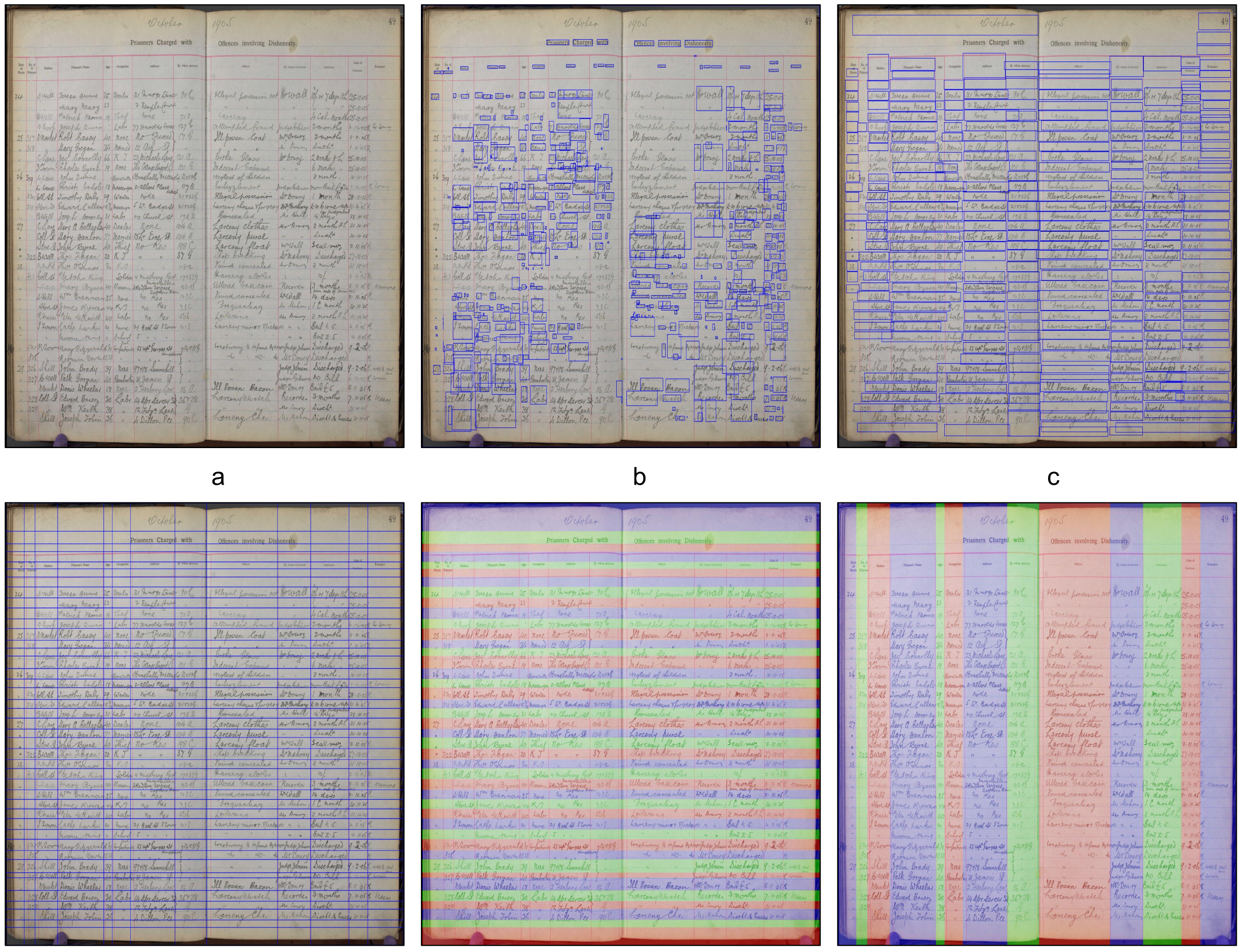
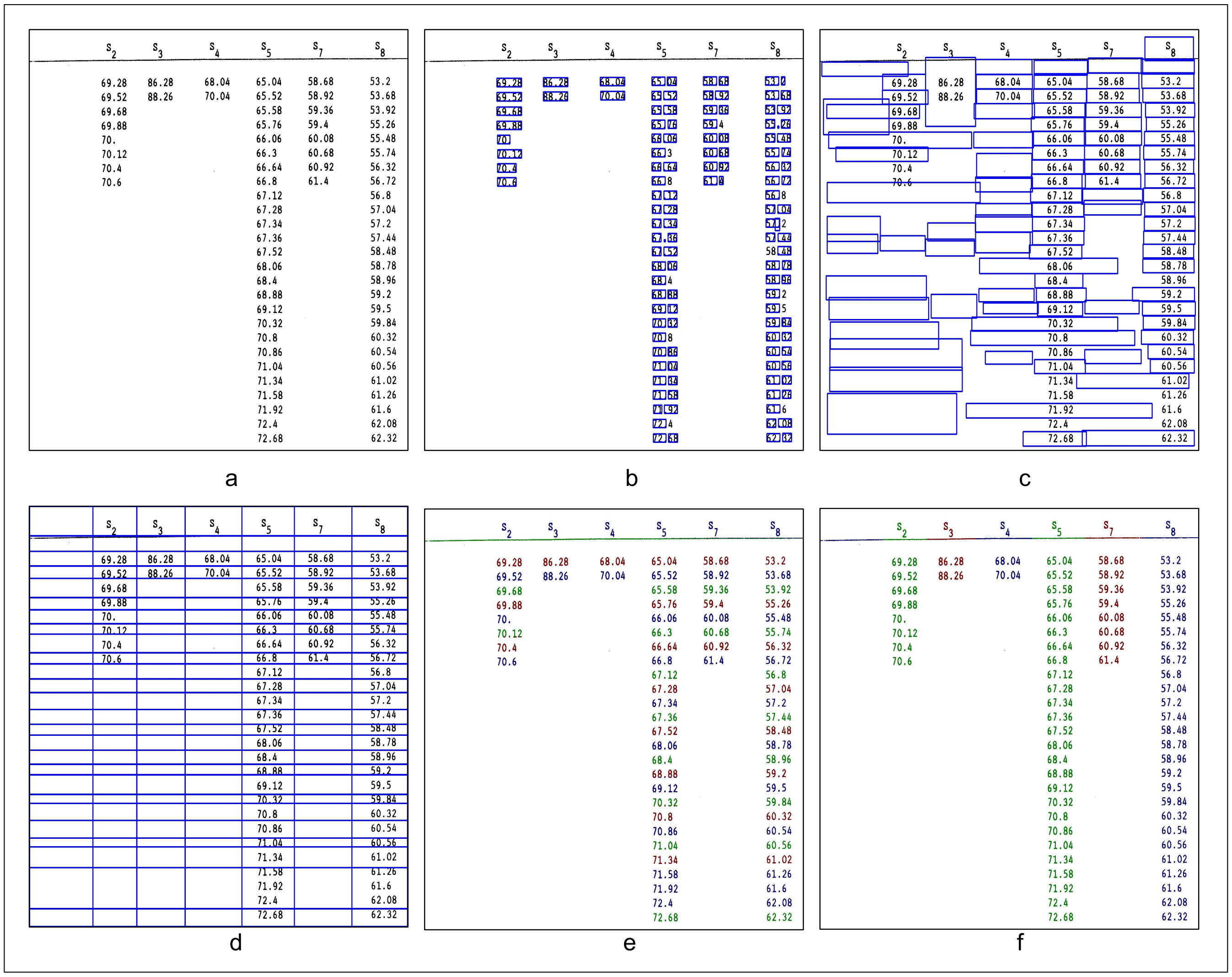
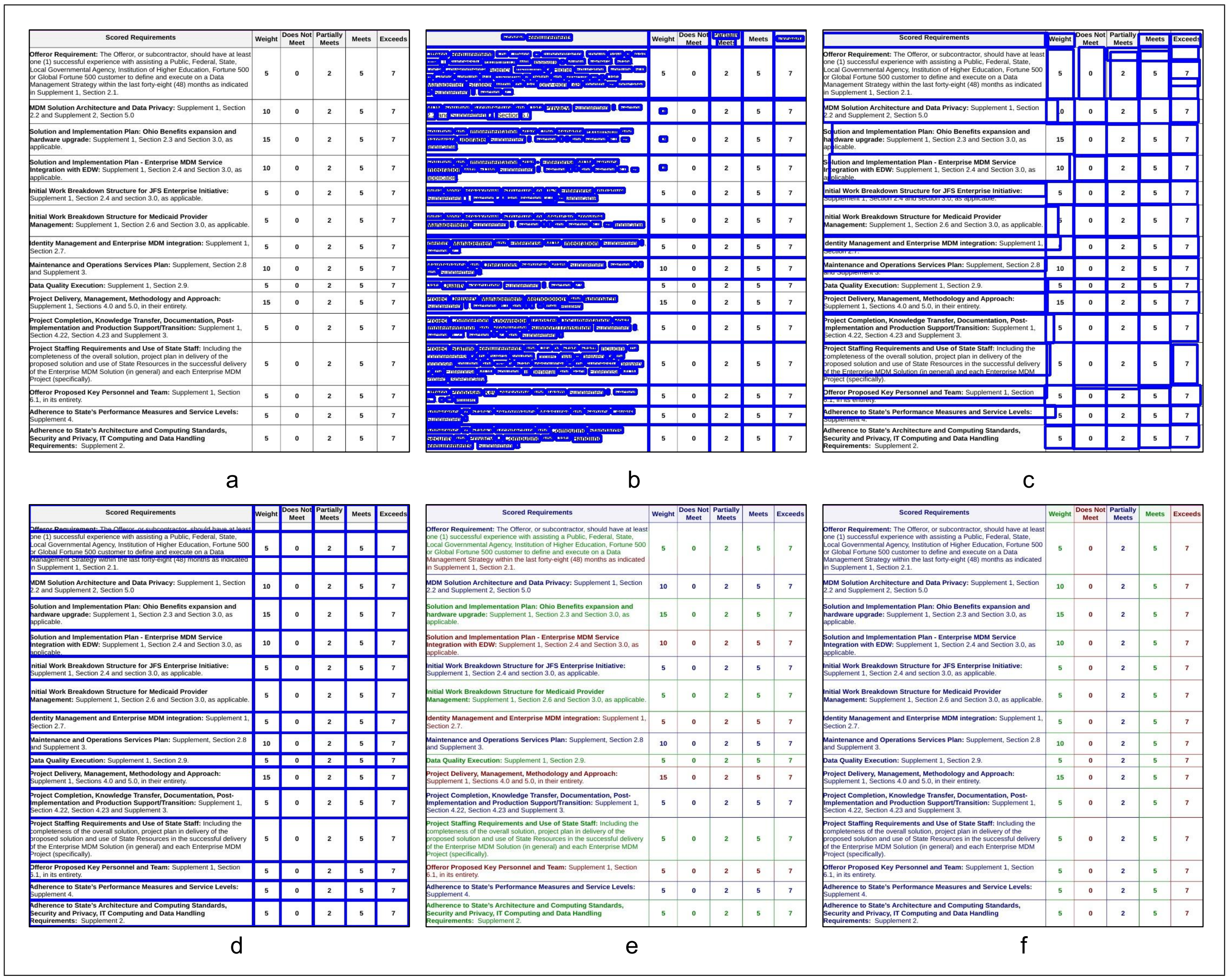


Figure 4. Illustrates visual results of ICDAR-2019. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding TOD-Net, (d) cell detection using intersection of detected row and column using TOD-Net, (e) cells which are row adjacent using TSR-Net, and (f) cells which are column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



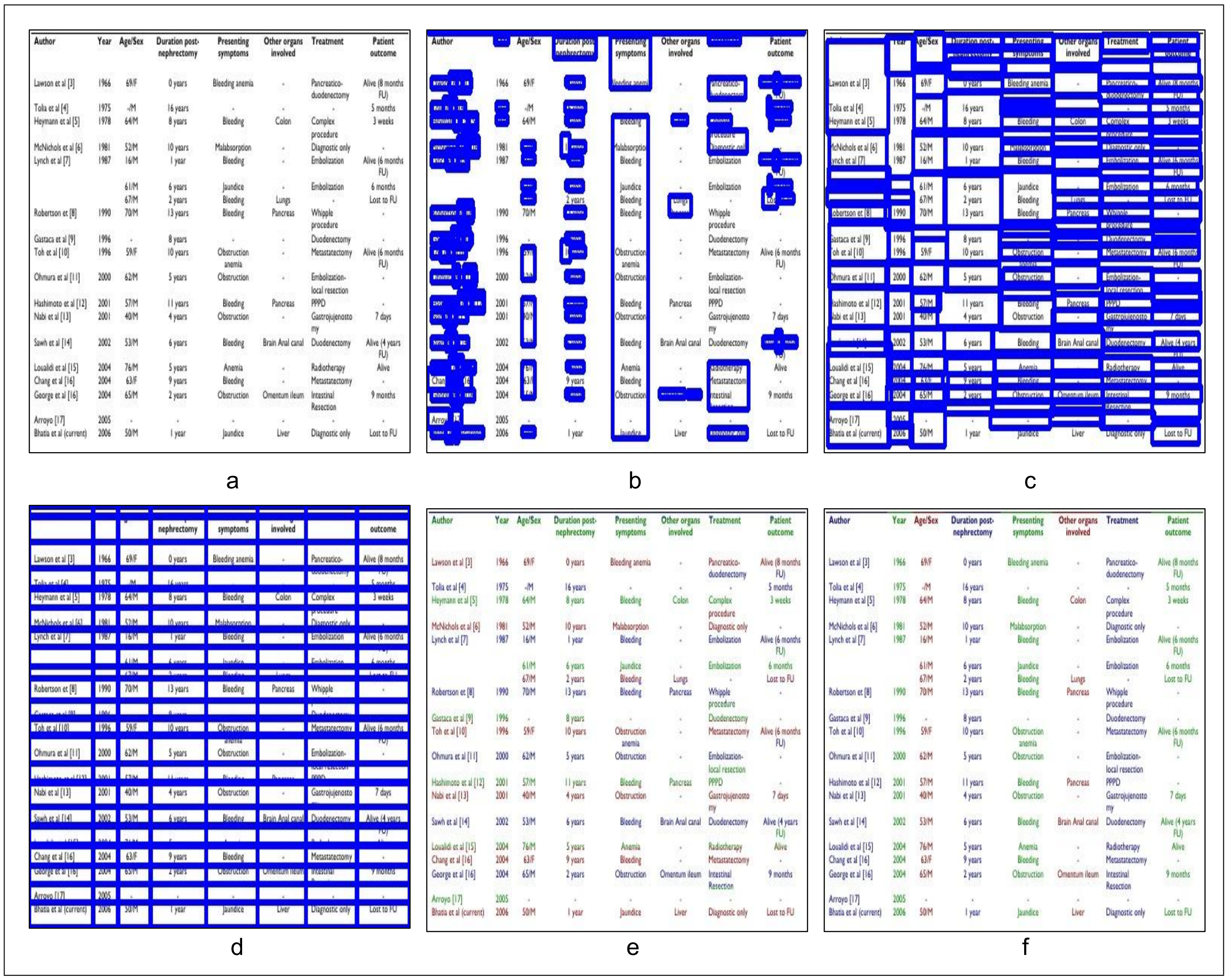
	s_2	s_3	s_4	s_5	s_7	s_8
	69.28	86.28	68.04	65.04	58.68	53.2
	69.52	88.26	70.04	65.52	58.92	53.68
	69.68			65.58	59.36	53.92
	69.88			65.76	59.4	55.26
	70.			66.06	60.08	55.48
	70.12			66.3	60.68	55.74
	70.4			66.64	60.92	56.32
	70.6			66.8	61.4	56.72
				67.12		56.8
				67.28		57.04
				67.34		57.2
				67.36		57.44
				67.52		58.48
				68.06		58.78
				68.4		58.96
				68.88		59.2
				69.12		59.5
				70.32		59.84
				70.8		60.32
				70.86		60.54
				71.04		60.56
				71.34		61.02
				71.58		61.26
				71.92		61.6
				72.4		62.08
				72.68		62.32

Figure 5. Illustrates visual results of UNLV. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding 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.



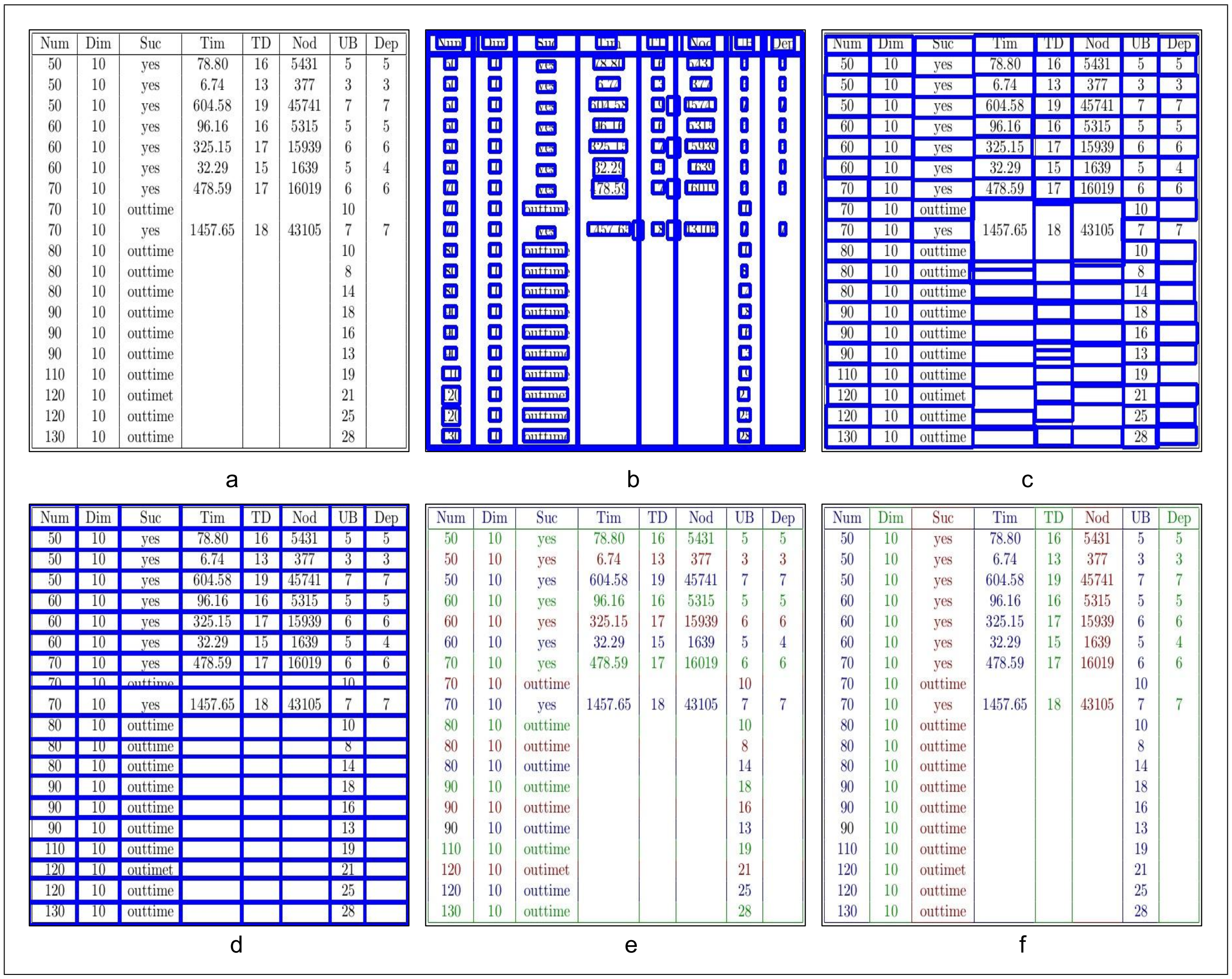
Scored Requirements	Weight	Does Not Meet	Partially Meets	Meets	Exceeds
Offeror Requirement: The Offeror, or subcontractor, should have at least one (1) successful experience with assisting a Public, Federal, State, Local Governmental Agency, Institution of Higher Education, Fortune 500 or Global Fortune 500 customer to define and execute on a Data Management Strategy within the last forty-eight (48) months as indicated in Supplement 1, Section 2.1.	5	0	2	5	7
MDM Solution Architecture and Data Privacy: Supplement 1, Section 2.2 and Supplement 2, Section 5.0	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 MDM integration: Supplement 1, Section 2.7.	5	0	2	5	7
Maintenance 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 and Production Support/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 solution, project plan in delivery of the proposed solution and use of State Resources in the successful delivery of the Enterprise MDM Solution (in general) and each Enterprise MDM Project (specifically).	5	0	2	5	7
Offeror Proposed Key Personnel and Team: Supplement 1, Section 6.1, in its entirety.	5	0	2	5	7
Adherence to State's Performance Measures and Service Levels: Supplement 4.	5	0	2	5	7
Adherence to State's Architecture and Computing Standards, Security and Privacy, IT Computing and Data Handling Requirements: Supplement 2.	5	0	2	5	7

Figure 6. Illustrates visual results of TableBank. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding 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.



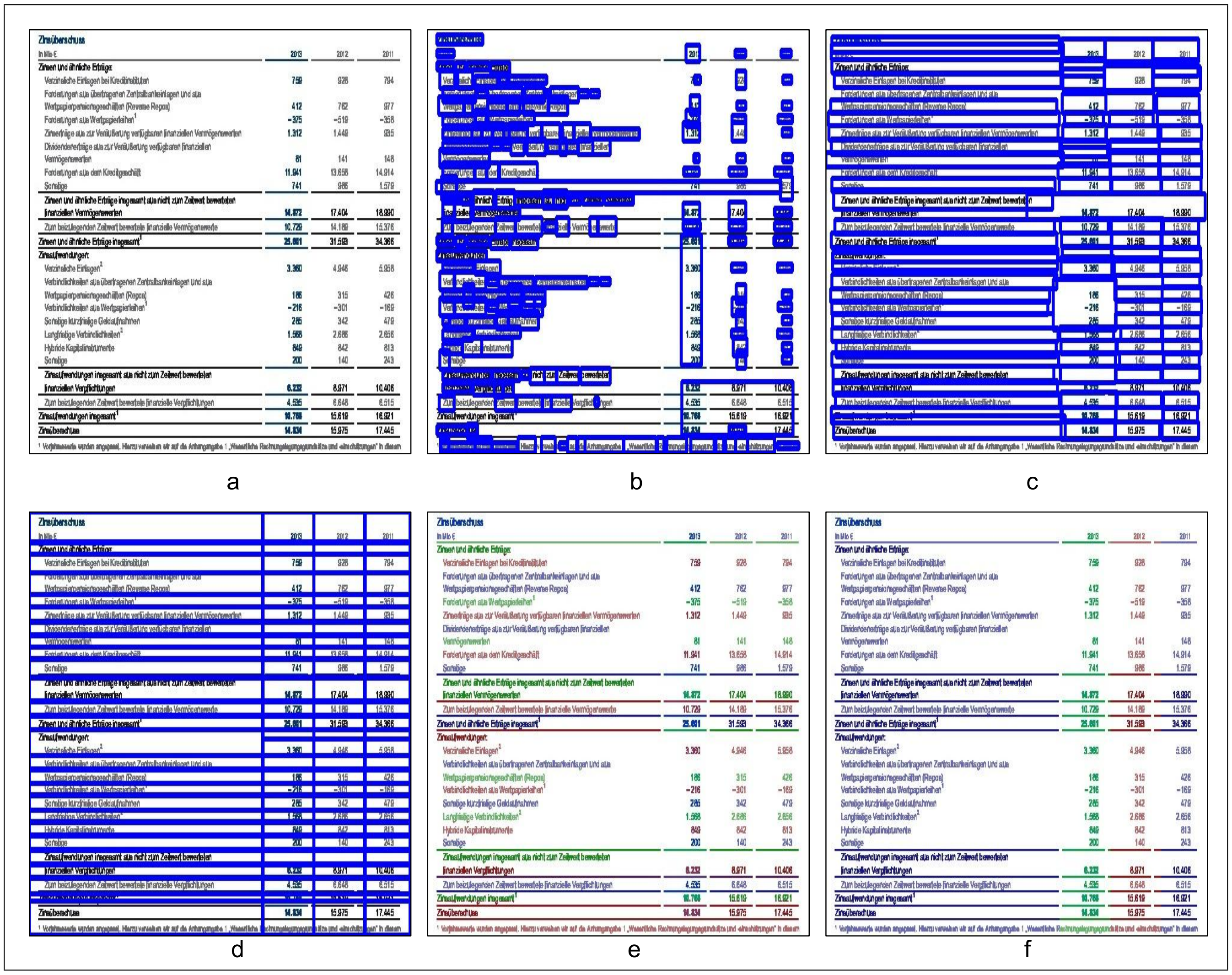
Author	Year	Age/Sex	Duration post-nephrectomy	Presenting symptoms	Other organs involved	Treatment	Patient outcome
Lawson et al [3]	1966	69/F	0 years	Bleeding anemia	-	Pancreatico-duodenectomy	Alive (8 months FU)
Tolia et al [4]	1975	-/M	16 years	-	-	-	5 months
Heymann et al [5]	1978	64/M	8 years	Bleeding	Colon	Complex procedure	3 weeks
McNichols et al [6]	1981	52/M	10 years	Malabsorption	-	Diagnostic only	-
Lynch et al [7]	1987	16/M	1 year	Bleeding	-	Embolization	Alive (6 months FU)
		61/M	6 years	Jaundice	-	Embolization	6 months
		67/M	2 years	Bleeding	Lungs	-	Lost to FU
Robertson et [8]	1990	70/M	13 years	Bleeding	Pancreas	Whipple procedure	-
Gastaca et al [9]	1996	-	8 years	-	-	Duodenectomy	-
Toh et al [10]	1996	59/F	10 years	Obstruction anemia	-	Metastatectomy	Alive (6 months FU)
Ohmura et al [11]	2000	62/M	5 years	Obstruction	-	Embolization-local resection	-
Hashimoto et al [12]	2001	57/M	11 years	Bleeding	Pancreas	PPPD	-
Nabi et al [13]	2001	40/M	4 years	Obstruction	-	Gastrojujenostomy	7 days
Sawh et al [14]	2002	53/M	6 years	Bleeding	Brain Anal canal	Duodenectomy	Alive (4 years FU)
Loualidi et al [15]	2004	76/M	5 years	Anemia	-	Radiotherapy	Alive
Chang et al [16]	2004	63/F	9 years	Bleeding	-	Metastatectomy	-
George et al [16]	2004	65/M	2 years	Obstruction	Omentum ileum	Intestinal Resection	9 months
Arroyo [17]	2005	-	-	-	-	-	-
Bhatia et al (current)	2006	50/M	1 year	Jaundice	Liver	Diagnostic only	Lost to FU

Figure 7. Illustrates visual results of PubTabNet. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding 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.



Num	Dim	Suc	Tim	TD	Nod	UB	Dep
50	10	yes	78.80	16	5431	5	5
50	10	yes	6.74	13	377	3	3
50	10	yes	604.58	19	45741	7	7
60	10	yes	96.16	16	5315	5	5
60	10	yes	325.15	17	15939	6	6
60	10	yes	32.29	15	1639	5	4
70	10	yes	478.59	17	16019	6	6
70	10	outtime				10	
70	10	yes	1457.65	18	43105	7	7
80	10	outtime				10	
80	10	outtime				8	
80	10	outtime				14	
90	10	outtime				18	
90	10	outtime				16	
90	10	outtime				13	
110	10	outtime				19	
120	10	outimet				21	
120	10	outtime				25	
130	10	outtime				28	

Figure 8. Illustrates visual results of SciTSR. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding 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.

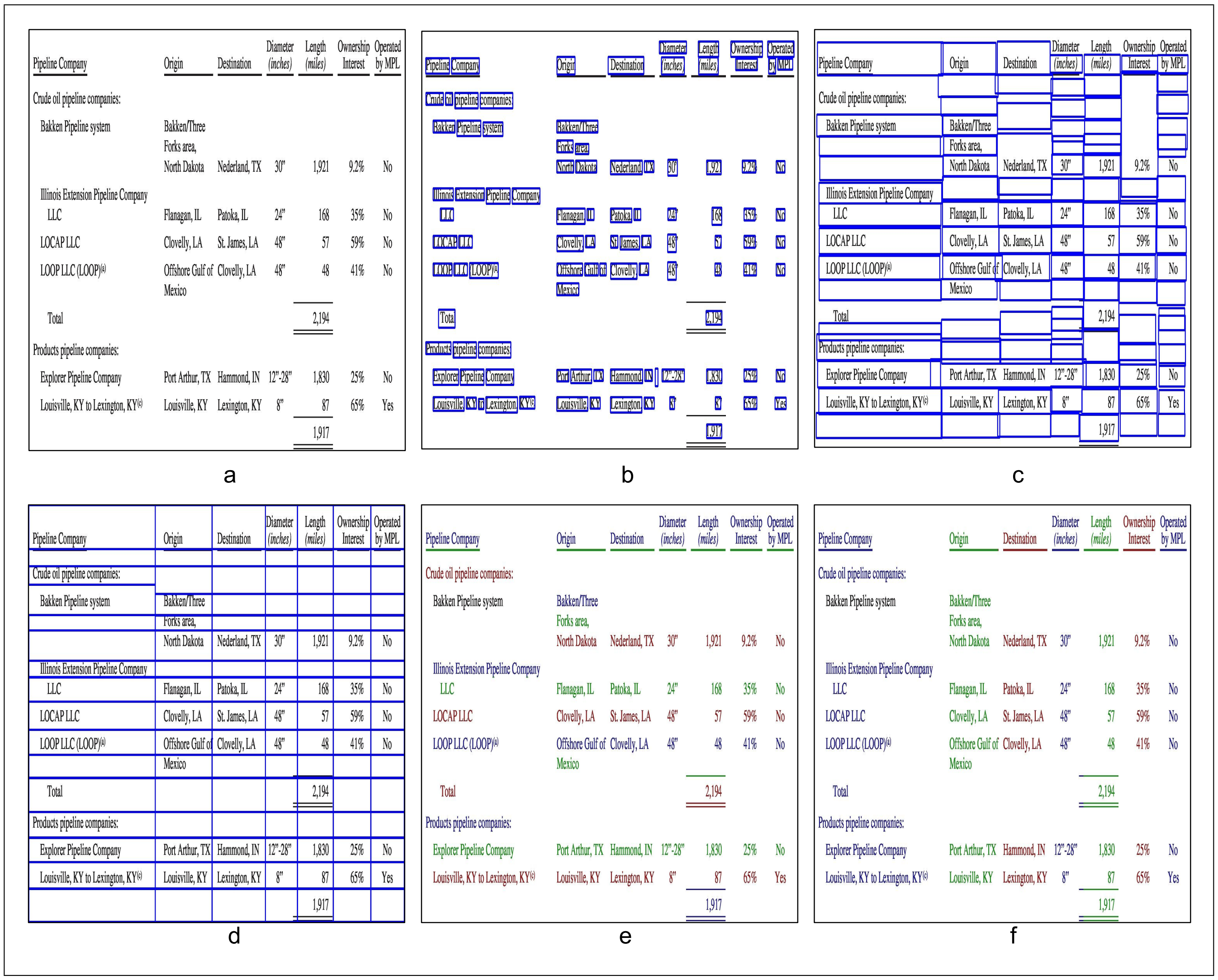


Zinsüberschuss

in Mio €	2013	2012	2011
Zinsen und ähnliche Erträge:			
Verzinsliche Einlagen bei Kreditinstituten	759	928	794
Forderungen aus übertragenen Zentralbankeinlagen und aus Wertpapierpensionsgeschäften (Reverse Repos)	412	762	977
Forderungen aus Wertpapierleihen[1]	−375	−519	−358
Zinserträge aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	1.312	1.449	935
Dividendenerträge aus zur Veräußerung verfügbaren finanziellen Vermögenswerten	81	141	148
Forderungen aus dem Kreditgeschäft	11.941	13.658	14.914
Sonstige	741	986	1.579
Zinsen und ähnliche Erträge insgesamt aus nicht zum Zeitwert bewerteten finanziellen Vermögenswerten	14.872	17.404	18.990
Zum beizulegenden Zeitwert bewertete finanzielle Vermögenswerte	10.729	14.189	15.376
Zinsen und ähnliche Erträge insgesamt[1]	25.601	31.593	34.366
Zinsaufwendungen:			
Verzinsliche Einlagen[1]	3.360	4.946	5.958
Verbindlichkeiten aus übertragenen Zentralbankeinlagen und aus Wertpapierpensionsgeschäften (Repos)	186	315	426
Verbindlichkeiten aus Wertpapierleihen[1]	−216	−301	−169
Sonstige kurzfristige Geldaufnahmen	285	342	479
Langfristige Verbindlichkeiten[1]	1.568	2.686	2.656
Hybride Kapitalinstrumente	849	842	813
Sonstige	200	140	243
Zinsaufwendungen insgesamt aus nicht zum Zeitwert bewerteten finanziellen Verpflichtungen	6.232	8.971	10.406
Zum beizulegenden Zeitwert bewertete finanzielle Verpflichtungen	4.535	6.648	6.515
Zinsaufwendungen insgesamt[1]	10.768	15.619	16.921
Zinsüberschuss	14.834	15.975	17.445

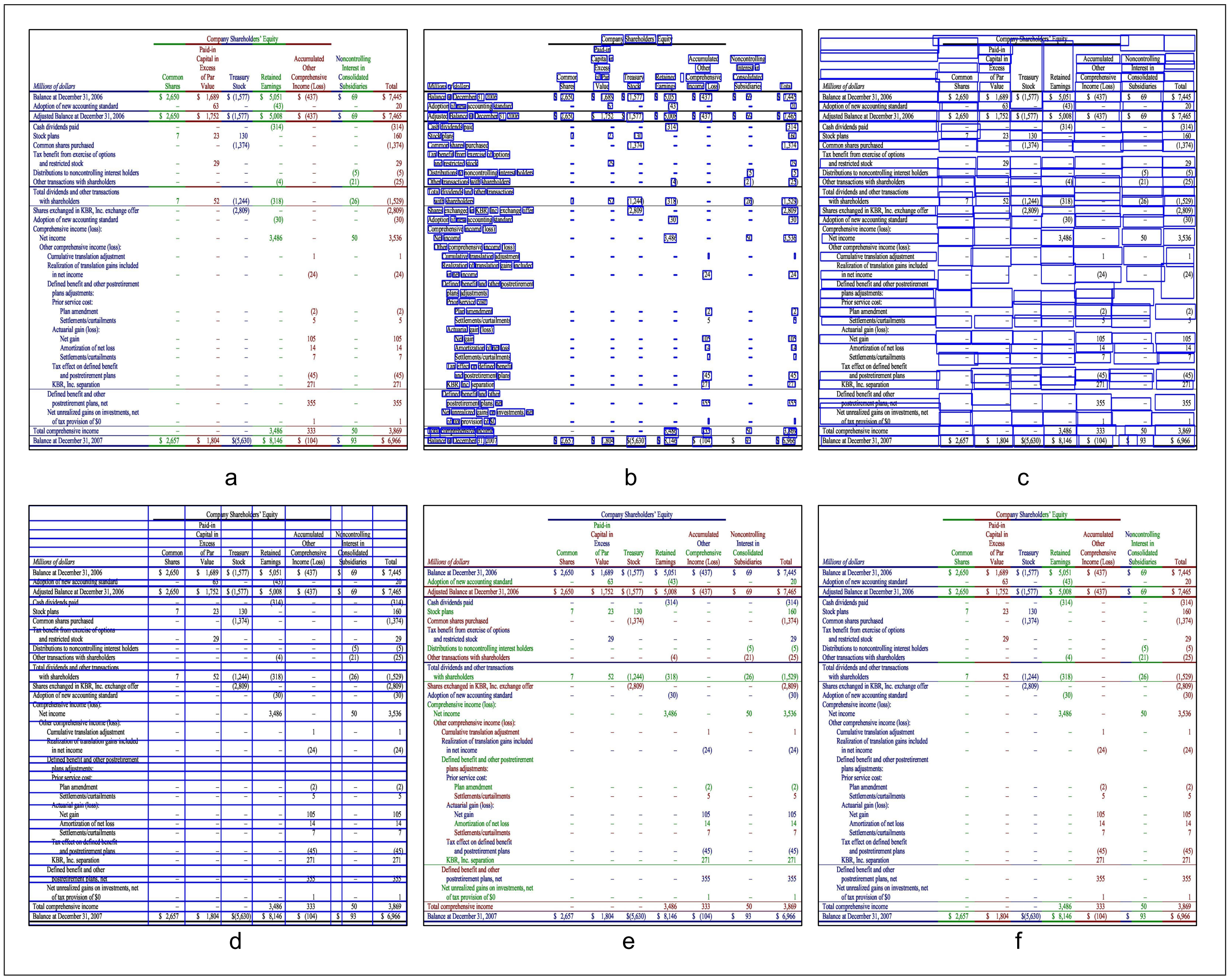
[1] Vorjahreswerte wurden angepasst. Hierzu verweisen wir auf die Anhangangabe 1 „Wesentliche Rechnungslegungsgrundsätze und -einschätzungen" in diesem

Figure 9. Illustrates visual results of TUCD. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding 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.



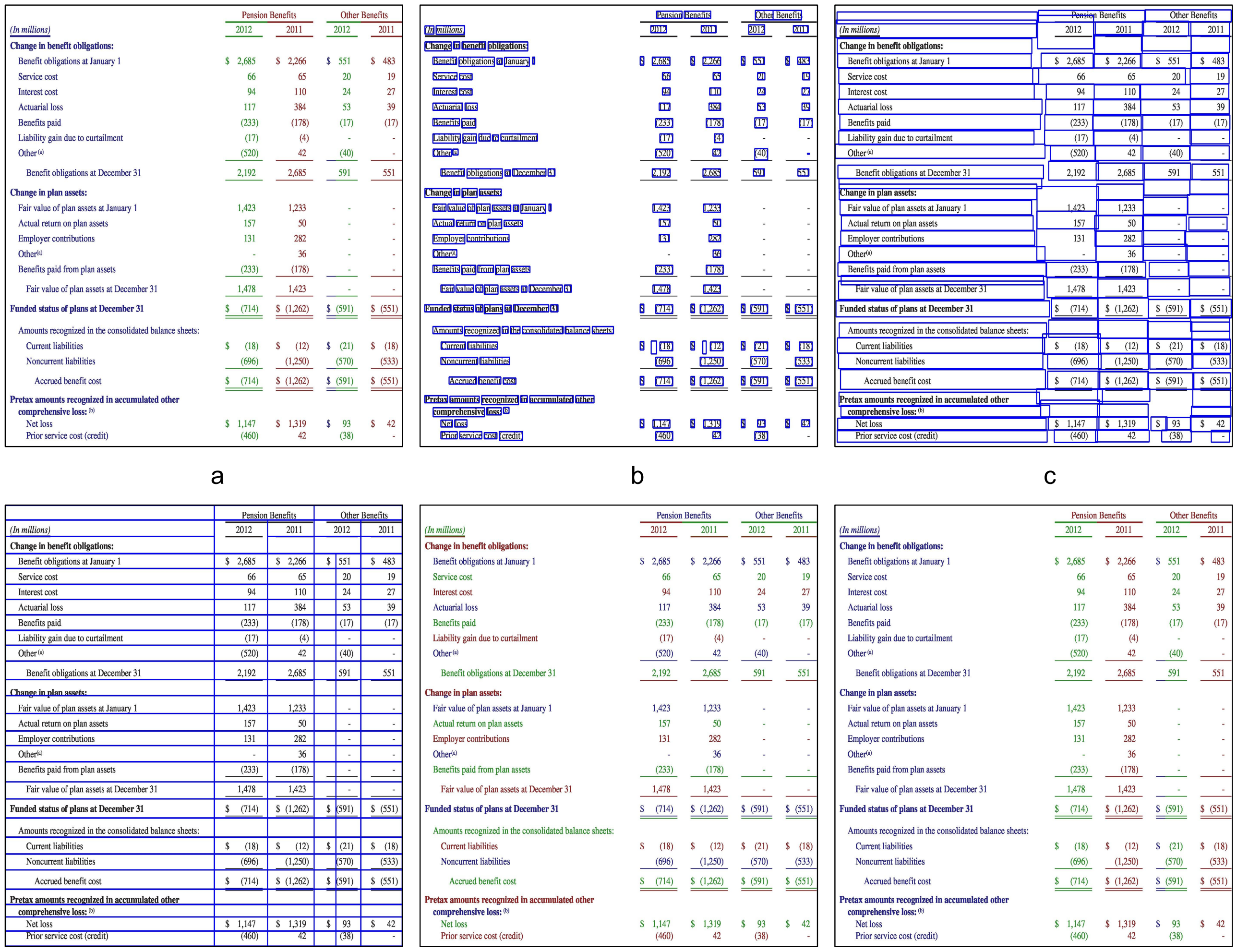
Pipeline Company	Origin	Destination	Diameter *(inches)*	Length *(miles)*	Ownership Interest	Operated by MPL
Crude oil pipeline companies:						
Bakken Pipeline system	Bakken/Three Forks area, North Dakota	Nederland, TX	30"	1,921	9.2%	No
Illinois Extension Pipeline Company LLC	Flanagan, IL	Patoka, IL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

Figure 10. Illustrates visual results of FinTabNet. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding 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.



	Company Shareholders' Equity						
Millions of dollars	Common Shares	Paid-in Capital in Excess of Par Value	Treasury Stock	Retained Earnings	Accumulated Other Comprehensive Income (Loss)	Noncontrolling Interest in Consolidated Subsidiaries	Total
Balance at December 31, 2006	$ 2,650	$ 1,689	$ (1,577)	$ 5,051	$ (437)	$ 69	$ 7,445
Adoption of new accounting standard	–	63	–	(43)	–	–	20
Adjusted Balance at December 31, 2006	$ 2,650	$ 1,752	$ (1,577)	$ 5,008	$ (437)	$ 69	$ 7,465
Cash dividends paid	–	–	–	(314)	–	–	(314)
Stock plans	7	23	130	–	–	–	160
Common shares purchased	–	–	(1,374)	–	–	–	(1,374)
Tax benefit from exercise of options							
and restricted stock	–	29	–	–	–	–	29
Distributions to noncontrolling interest holders	–	–	–	–	–	(5)	(5)
Other transactions with shareholders	–	–	–	(4)	–	(21)	(25)
Total dividends and other transactions							
with shareholders	7	52	(1,244)	(318)	–	(26)	(1,529)
Shares exchanged in KBR, Inc. exchange offer	–	–	(2,809)	–	–	–	(2,809)
Adoption of new accounting standard	–	–	–	(30)	–	–	(30)
Comprehensive income (loss):							
Net income	–	–	–	3,486	–	50	3,536
Other comprehensive income (loss):							
Cumulative translation adjustment	–	–	–	–	1	–	1
Realization of translation gains included							
in net income	–	–	–	–	(24)	–	(24)
Defined benefit and other postretirement							
plans adjustments:							
Prior service cost:							
Plan amendment	–	–	–	–	(2)	–	(2)
Settlements/curtailments	–	–	–	–	5	–	5
Actuarial gain (loss):							
Net gain	–	–	–	–	105	–	105
Amortization of net loss	–	–	–	–	14	–	14
Settlements/curtailments	–	–	–	–	7	–	7
Tax effect on defined benefit							
and postretirement plans	–	–	–	–	(45)	–	(45)
KBR, Inc. separation	–	–	–	–	271	–	271
Defined benefit and other							
postretirement plans, net	–	–	–	–	355	–	355
Net unrealized gains on investments, net							
of tax provision of $0	–	–	–	–	1	–	1
Total comprehensive income	–	–	–	3,486	333	50	3,869
Balance at December 31, 2007	$ 2,657	$ 1,804	$(5,630)	$ 8,146	$ (104)	$ 93	$ 6,966

Figure 11. Illustrates visual results of FinTabNet. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding 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.



	Pension Benefits		Other Benefits	
(In millions)	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)	$ (1,262)	$ (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)	$ (1,262)	$ (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)	-

a b c d e f

Figure 12. Illustrates visual results of FinTabNet. (a) original table image, (b) word detection using Tesseract, (c) cell detection uding 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.

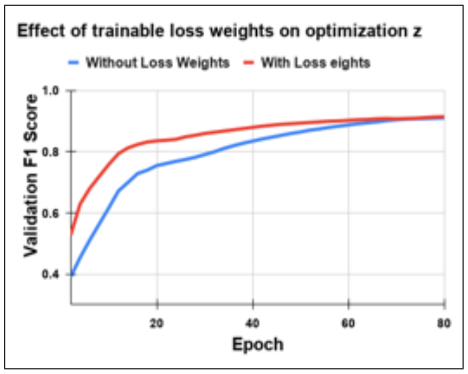


Figure 13. Shows the plot of validation accuracy against epochs. Blue line indicates scores without the use of loss weights, while red line indicates scores when trainable loss weights were used. In both the cases, same weight initialization was used.