STL-CQA: Supplementary Material

Hrituraj Singh
Adobe Research
hrisingh@adobe.com

Sumit Shekhar
Adobe Research
sushekha@adobe.com

1 Dataset

In this section, we describe our LEAF-QA++ Dataset. In Table 1, we present the statistics of the different types of charts, for the sake of completion even though the numbers remain same as LEAF-QA. We primarily discuss the changes (i.e. delta) we made to LEAF-QA while not focusing much on the details of things which have been left same. We discuss both question as well as chart changes.

Questions: We increase the number of question templates from 35 to 75 while adding 3-8 manually written paraphrases for each. On the basis of category, we enlist sample questions along with their paraphrases:

(a) **Structural:**

- What type of graph is this ?
  - *What is the type of this graph ?*
  - *Which category of graph does this figure belong to ?*
  - *What is the graph type ?*
  - *Which type of graph does this image represent ?*
- Is there a legend in this graph ?
  - *Do we have a legend in this graph ?*
  - *Is the legend visible ?*
  - *Does there exist a legend in the figure*
  - *Does this graph have a legend ?*
- How many labels are there in the legend ?
  - *What is the number of legend labels in this graph ?*
  - *What is the count of legend labels ?*
  - *How many legend labels are there in this graph ?*
- Is there a grid in this graph ?
  - *Does the graph have a grid ?*
  - *Does there exist a grid in this graph ?*
  - *Is a grid present in this graph ?*

(b) **Data**

- What does the i bar from left in each group represent ?
  - *What is bar i from left in each group representing ?*
  - *If we count i from left and reach a bar , what does that bar represent ?*
- Does the value of legend_label_i monotonically increase over xtitle?
  - *Does the legend_label_i never decrease or remain same over xtitle ?*
  - *Is there a continuous increase for legend_label_i over xtitle ?*
  - *Is the legend_label_i only increasing over xtitle ?*
  - *Is the legend_label_i montonically increasing over the xtitle axis ?*
- How many groups or stacks of bars have ratio less than 2 between highest and lowest value bars ?
  - *For how many groups or stacks of bars does the ration remain lower than 2 between highest and lowest value bars ?*
  - *How many groups or stacks of bars have highest bars value falling short of the two times value of the lowest value bars ?*
  - *In what number of groups or stacks does the ratio between highest value bar and lowest value bar falls short of 2 ?*

Type	Train	Test-Familiar	Test-Novel
Vertical Stacked Bar Graph	13403	2736	627
Horizontal Stacked Bar Graph	13720	2686	623
Vertical Grouped Bar Graph	8561	1756	597
Horizontal Grouped Bar Graph	8587	1674	653
Linegraph	41881	8381	2500
Scatter Plot	41710	8336	550
Pie Chart	7006	1444	1250
Donut Chart	21204	4221	1248
Horizontal Box Plots	20961	4203	48
Vertical Box Plots	21012	4167	52

Table 1: Statistics of different chart types over three splits of the dataset

Figure 1: Samples from the proposed dataset

Item	Remarks
Font Size	[4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8]
Font Families	25 Font Families
Background Styles	15 Background Styles
Text on Bars	Present in Grouped bar plots only with 50% presence and 50% rotation probability
Random Axis Disappearance	Absent only in Grouped Bar Plots with Text on bars
Width Variation (Bars)	[0.1,0.15,0.2,0.25]
Gridlines (Width)	Uniformly Sampled from (0.1,0.55)
Exploding Pie Charts	Explosion happens with 50% probability at a randomly selected pie (one)
Axis Ticks	Random Appearance of minor ticks *Color* : ['r', 'b','m','k] *length* : minor (3,4,5), major (6,7,8) *width* : [1,1.5,2,2.5]

Table 2: Changes introduced to the LEAF-QA Images

- In or at which xtitle does legend_label_i have highest ytitle ?
  - *Which xtitle does the legend_label_i have highest ytitle for ?*
  - *For which xtitle does the legend_label_i have highest ytitle ?*
  - *Which is the xtitle having highest ytitle*

for legend_label_i ?

(c) **Relational**

- Between legend_label_i and legend_label_i , which has higher ytitle for xlabel_i ?
  - *For xlabel_i , which one has higher ytitle between legend_label_i and legend_label_i ?*
  - *Which of the point between legend_label_i and legend_label_i has higher ytitle for xlabel_i ?*
  - *For xlabel_i , which of the point between legend_label_i and legend_label_i has higher ytitle ?*
- Does there exist any xtitle where legend_label_i has higher ytitle than legend_label_i ?
  - *Is there any xtitle for which legend_label_i has higher ytitle than legend_label_i ?*
  - *Do we have atleast one xtitle where legend_label_i has higher ytitle than legend_label_i ?*
  - *Does legend_label_i have higher ytitle than legend_label_i for any xtitle ?*
  - *Is there an existence of xtitle where legend_label_i has higher ytitle than legend_label_i ?*
- In what xtitle is the sum of legend_label_i and legend_label_i lower than legend_label_i ?
  - *Which xtitle has the value of legend_label_i and legend_label_i combined together less than that of legend_label_i ?*
  - *For which xtitle does the sum of values of legend_label_i and legend_label_i fall short of legend_label_i ?*
  - *Which is the xtitle for which the sum of legend_label_i and legend_label_i is lower than legend_label_i ?*
  - *For which xtitle do we have sum of legend_label_i and legend_label_i lesser than legend_label_i ?*
- In or at which xtitle does legend_label_i and legend_label_i have highest diff ?
  - *What point in xtitle does legend_label_i and legend_label_i have highest difference at ?*
  - *Which is the xtitle for which legend_label_i and legend_label_i have highest difference ?*
  - *What is the xtitle that has highest difference between legend_label_i and legend_label_i ?*

Charts: We introduce a variety of changes in the chart images as well to make them more diverse and simulate real world scenario. Some prominent changes include - invisible-axes, axes major and minor ticks, background style and font variations as summarized in Table 2 and some samples shown in Fig. 1

2 Localization

For localization, we generate masks using geometrical methods since only bounding box information is available in the data. To generate masks for rectangular objects like bars, boxes, text-objects - the process is fairly simple. For line, pie or donut, however, the mechanism requires explanation. For lines, the bounding box is provided only for the marker points - we use those marker points to generate rectangular bounding boxes (and masks). For pie and donuts, we use bounding boxes to find the center of the pie (or donut). We then find out coordinates on the circle perimeter by 1 degree movements along the circumference using projections of radius (again found using bounding boxes). We show some results using our detection method as a sample and provide quantitative analysis over the main 20 elements of the chart in Table. 3

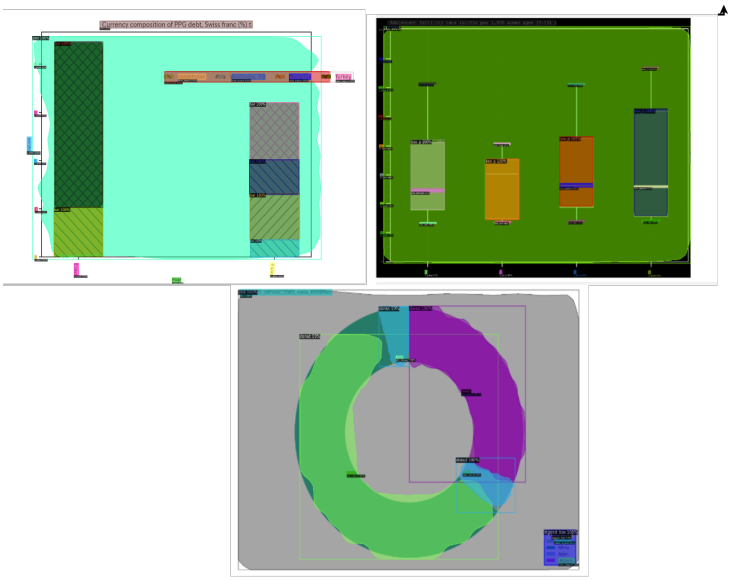

Figure 2: Sample Detector Results

Element	P	R	Element	P	R	Element	P	R	Element	P	R
Legend Box	0.94	0.98	Pie Values	0.99	0.98	Donut	0.98	0.99	Legend Label	0.88	0.99
Legend Patch	0.94	0.73	Legend Title	0.96	0.89	Title	1.0	0.99	Line	0.97	0.96
Y-axis Label	0.99	0.99	Marker	0.92	0.65	Y-Title	0.99	0.99	X-axis Label	1.0	0.99
X-Title	1.0	1.0	Bar	0.93	0.94	Pie	0.97	0.94	Box	0.96	0.93
Box Minimum	0.80	0.67	Box Maximum	0.60	0.55	Box Median	0.64	0.58	Pie Label	0.98	0.99

Table 3: Result on test set for chart elements detection framework