Many-Layer Hotspot Detection by Layer-Attentioned Visual Question Answering

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BACKGROUND & MOTIVATION

- **Motivation**
  - Defects are generated due to the compounding effects from different process and inter-layer process variations
- **Problem: Many-Layer Hotspot Detection**
  - Critical pattern to a defect type

- **Challenges**
  1) Pattern dimension varies for different defect types
  2) Polygons of a hotspot pattern reside over many layers
 3) The importance and relevance of each layer varies for different defect types

NEW INSIGHTS
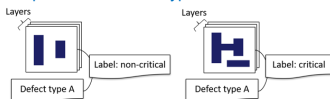
- **Remodeling: Visual Question Answering (VQA)**
  - Answer if a pattern is critical to a specific defect type
  - One model can answer all the defect types

- **Objective: maximize the answering accuracy**
- **Solution: VQA with layer attention mechanism**
 - Identify the importance and relevance of each layer for different defect types
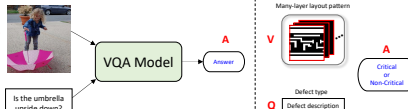
DESCRIPTION

- **Overall Pipeline of Our VQA System**
  1. Feature extraction: layout representation, sentence embedding neural network
  2. Feature fusion: merge defect description and layout feature
  3. Classifier: answer critical or non-critical
  4. Layer attention mechanism: focus on the important layers
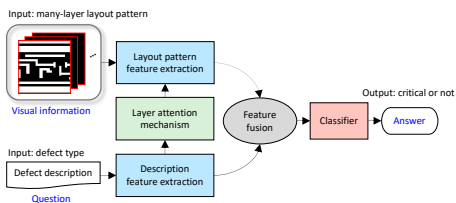
- **Layer Attention Mechanism**
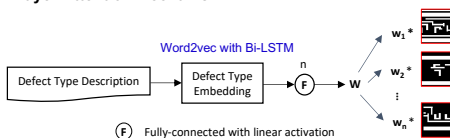
- **The Layered Relevance Weights of Partial Defect Types**
 - Similar defect type descriptions have similar weights
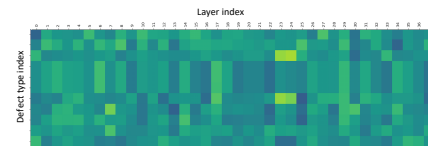
QUANTITATIVE IMPACT

- **Dataset**
  - 7 layouts with sub-14nm process, 79,593 triple data
  - V: a 38-layer layout pattern, Q: one of 57 defect types
  - 80-20 split for training and testing
- **The accuracies for different defect types**

	Defect type category	A	B	C	D	E	F
	# of patterns	1372	52	9159	2411	1738	664
Baseline VQA	Testing accuracy	93.88 %	94.23 %	96.99 %	97.35 %	98.39 %	98.80 %
	Miss	20	0	101	34	13	4
	False alarm	64	3	175	30	15	4
Our VQA	Testing accuracy	98.54 %	98.08 %	98.20 %	99.34 %	99.77 %	99.85 %
	Miss	1	0	64	3	0	0
	False alarm	19	1	101	13	4	1

- **The Average Question-Answering Accuracy**
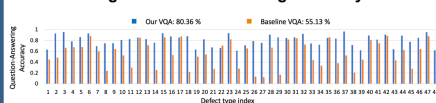
SUMMARY AND CONCLUSION

- We address a new **many-layer hotspot pattern extraction** challenge
- We investigate the **linkage between many-layer hotspot patterns and potentially induced defect types**
- This is the first work that models the hotspot pattern extraction task as a **Visual Question Answering** problem
- We devise a **layer-attentioned VQA model** to identify the relevance of each layer for different defect types
- Experimental results show that the proposed model has superior question-answering ability