Exemplar Based Experience Transfer

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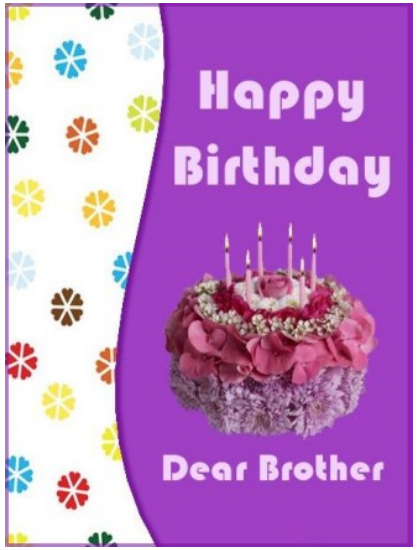
Banners, Banners Everywhere…

Hoardings

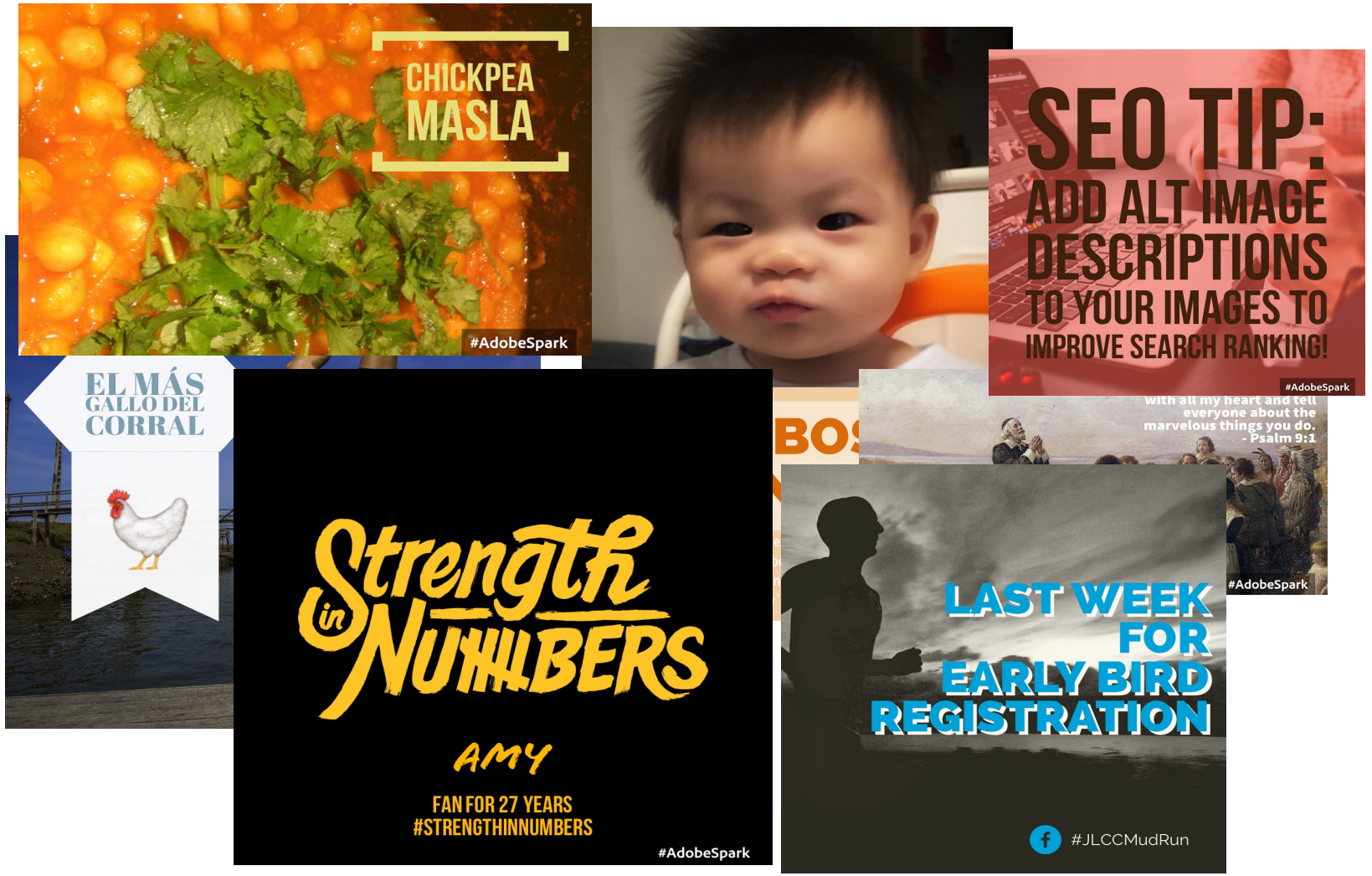
Web ads

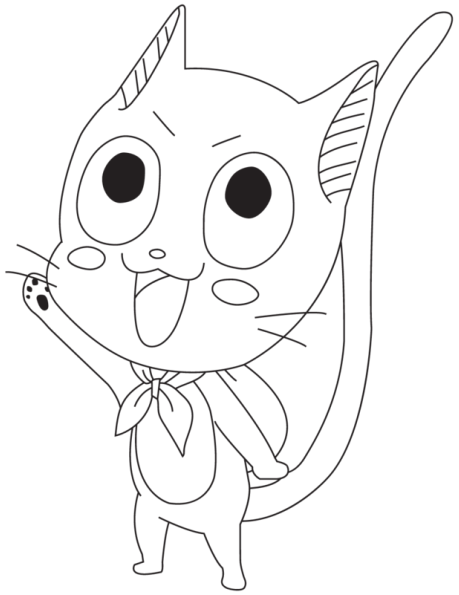
Flyers



Greetings

Huge Corpus of Designs!





Opportunity for automation…

Wish I could put my content in those banners!

It would be nice if I could pick the elements I like!

Wish there was a system to combine these elements!

Problem Statement…

Given a set of content and exemplar images, transfer the content into the inspirational experience.

What is content here?

What are exemplar images?

What is experience here?

Happy Birthday! May you achieve what you desire...Best Wishes

+

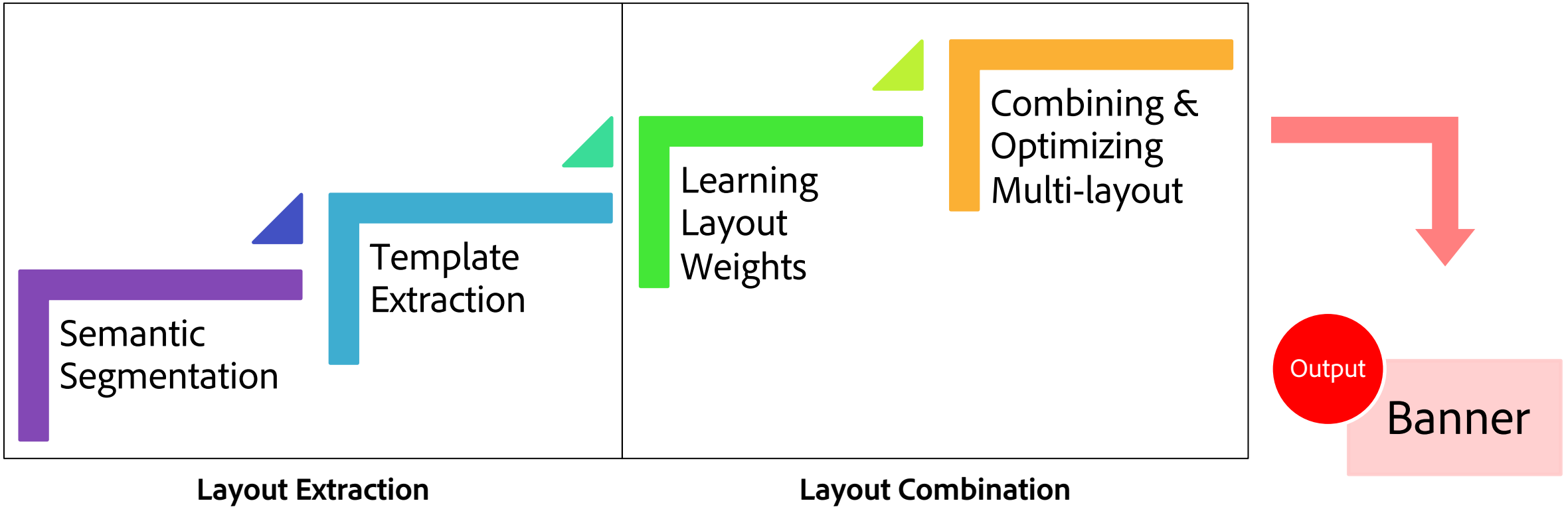
The objective is…

Layout Extraction

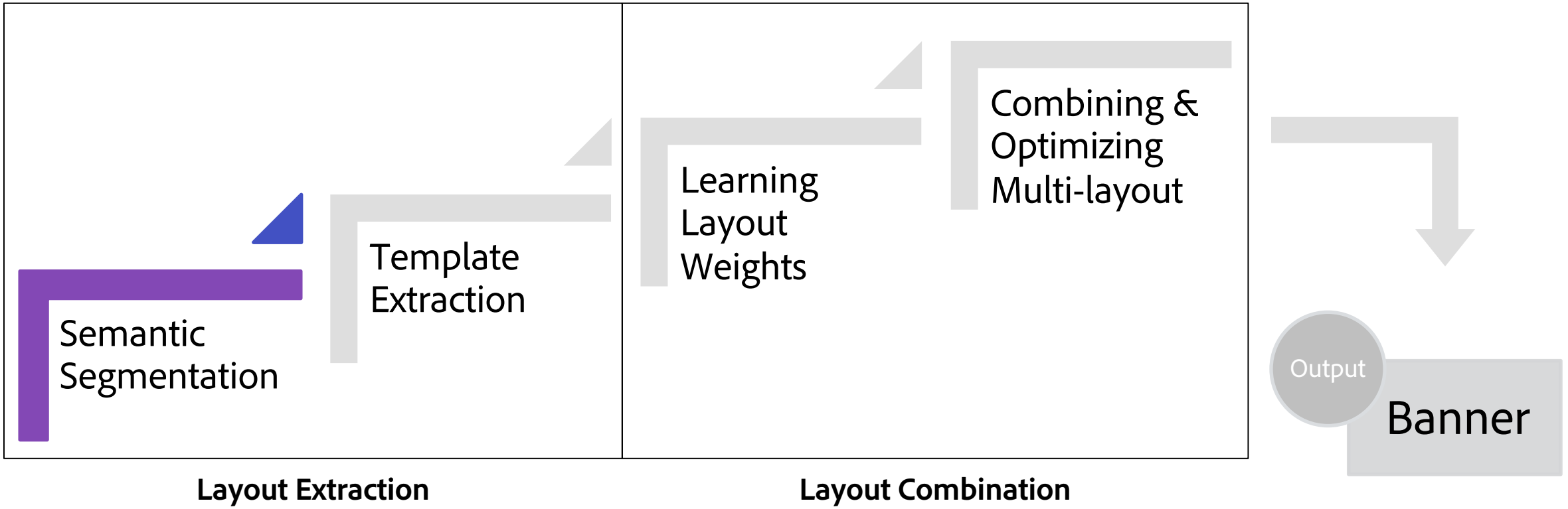
Layout Extraction

Layout Combination

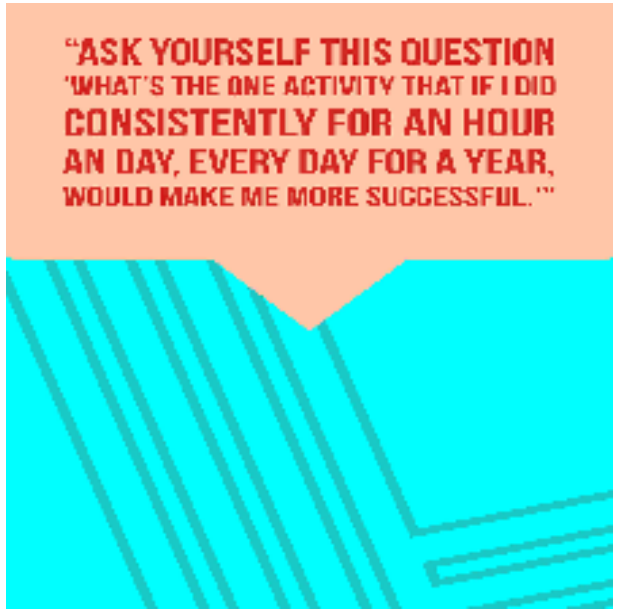
Solution Approach



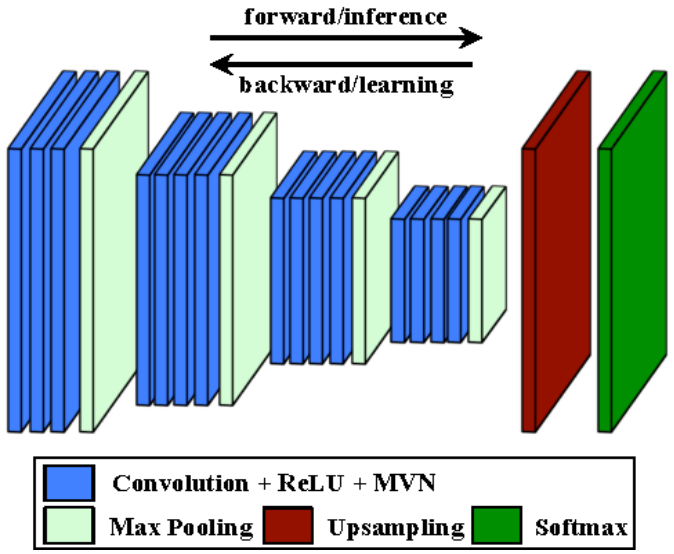
Solution Approach



Semantic Segmentation



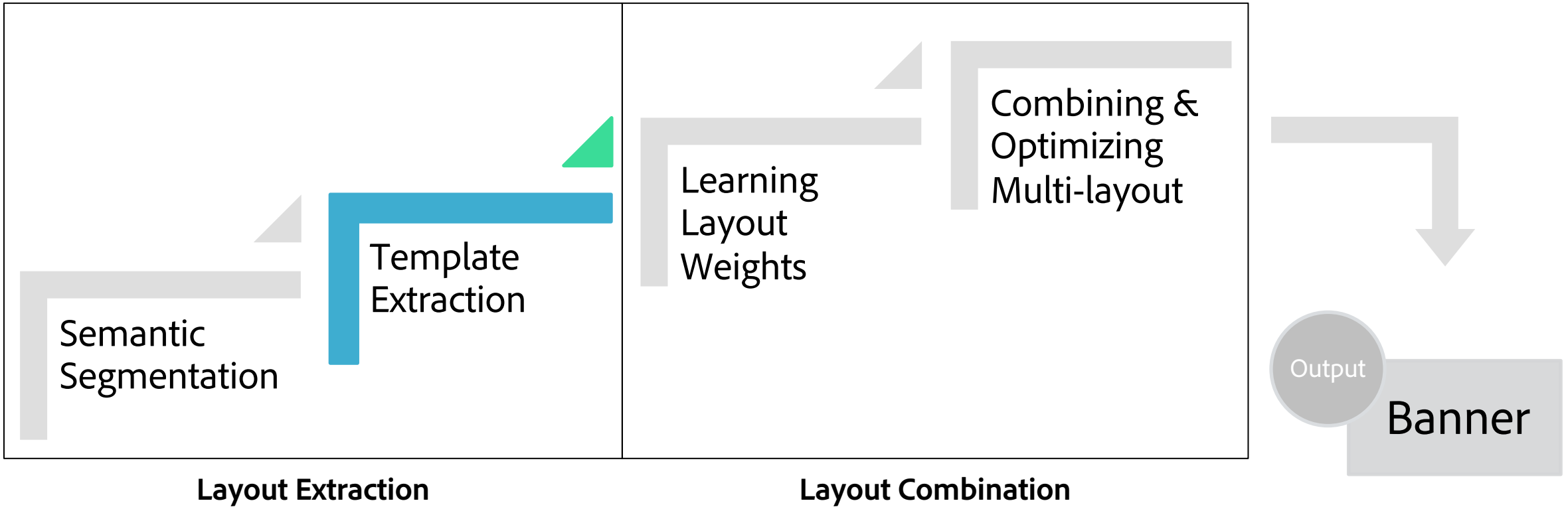
Input Image



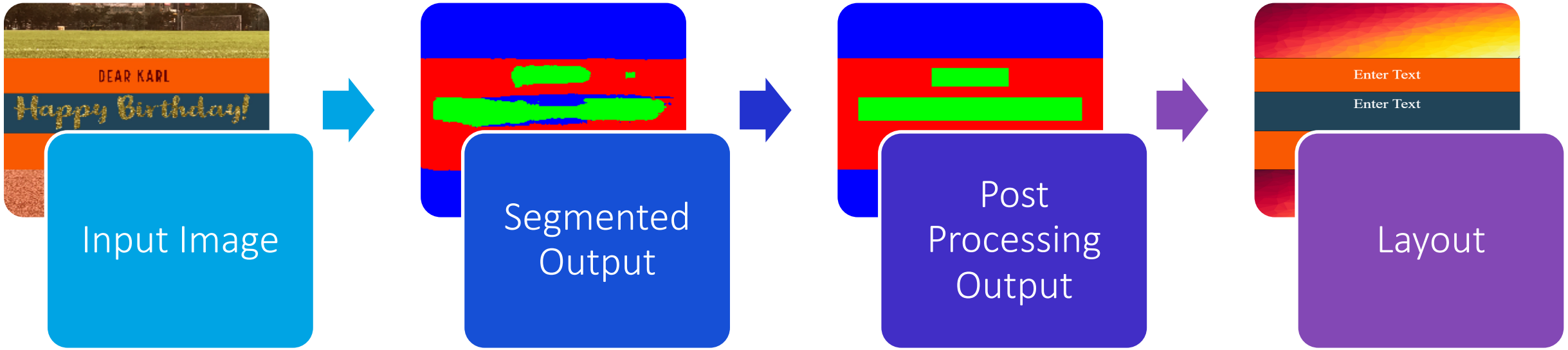
FCN output

1. Long, J., Shelhamer, E., & Darrell, T. (2015). Fully convolutional networks for semantic segmentation. In *Proceedings of the IEEE conference on computer vision and pattern recognition* (pp. 3431-3440).
2. Yang, X., Yumer, E., Asente, P., Kraley, M., Kifer, D., & Giles, C. L. (2017, July). Learning to extract semantic structure from documents using multimodal fully convolutional neural networks. In *The IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*.

Solution Approach



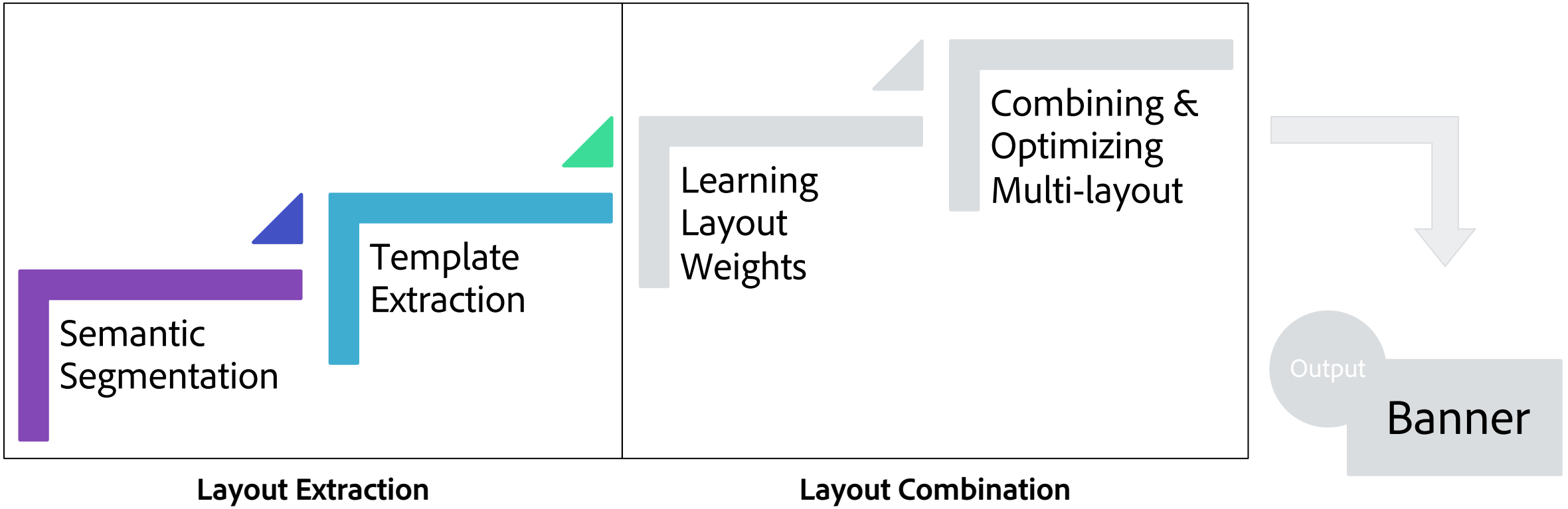
Template Extraction



Algorithm 1 Design Element Extract

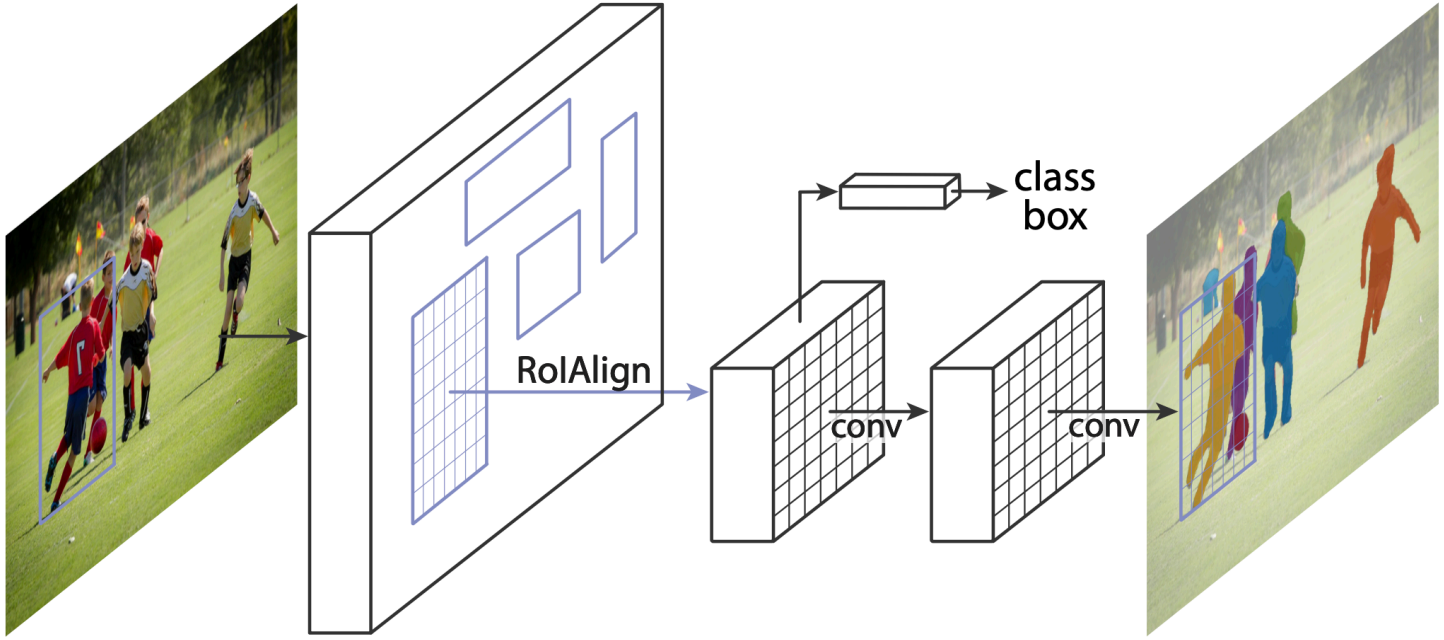
Input I = Image output of semantic segmentation
Initialize $L = \emptyset$
while there is an unvisited pixel **do**
    Run DFS from the unvisited pixel N to find a connected component C
    Maintain the 4 points of C closest to the 4 corners of I in **Box** while running DFS
    L.append(Box)
Filter L based on region size
return L

Solution Approach



Mask R-CNN based Segmentation & Template Extraction

- Object Detection Framework for finding template elements…



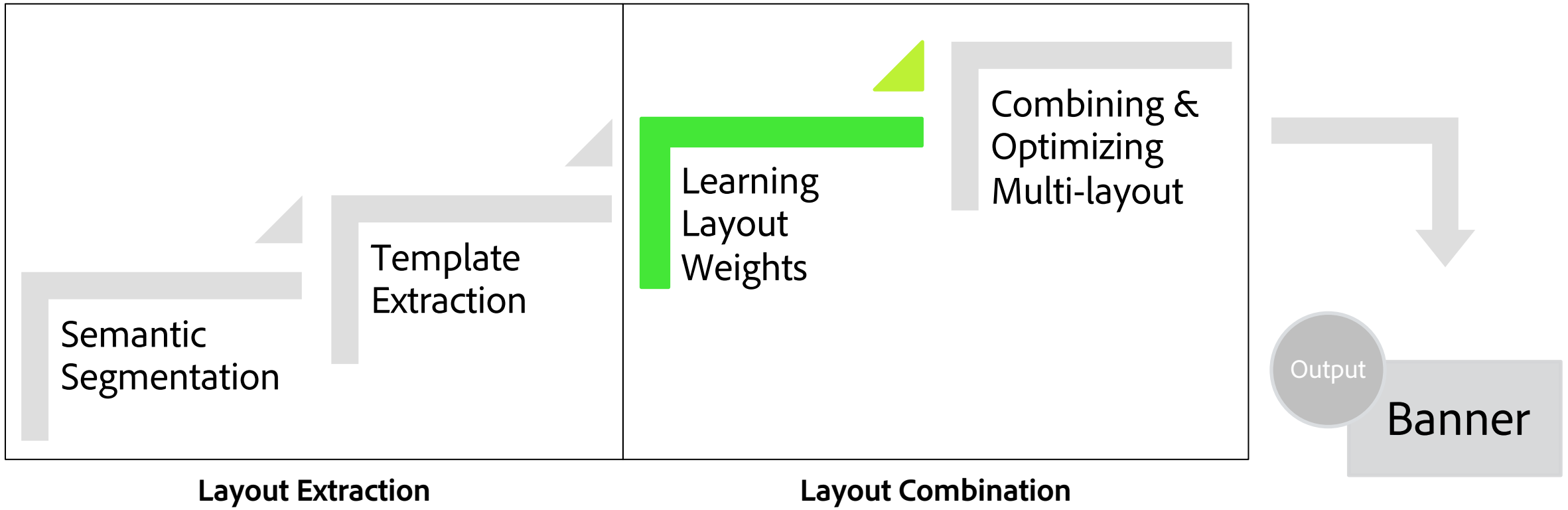
1. He, Kaiming, et al. "Mask r-cnn." *Proceedings of the IEEE international conference on computer vision*. 2017.

Evaluation of Layout Extraction

	Accuracy	F1 Score
FCNN	0.83	0.61
FCNN + Template Extraction	0.80	0.58
Mask R-CNN	0.79	0.50

- FCNN outperforms Mask R-CNN model in segmentation task.
- But FCNN output requires post processing to get an editable template.
- Here, accuracy decreases as we move from pixel level to bounding box level.

Solution Approach

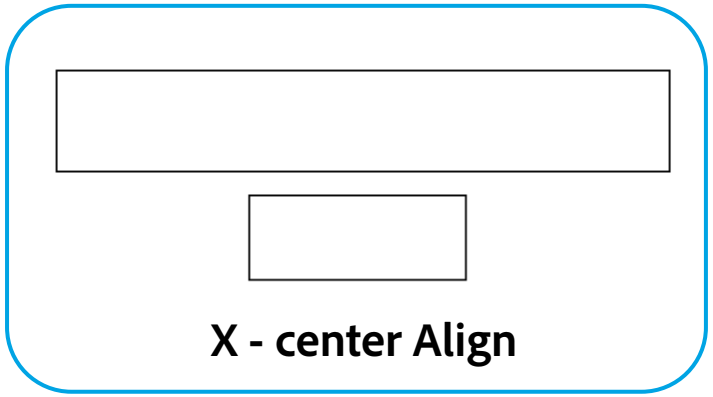


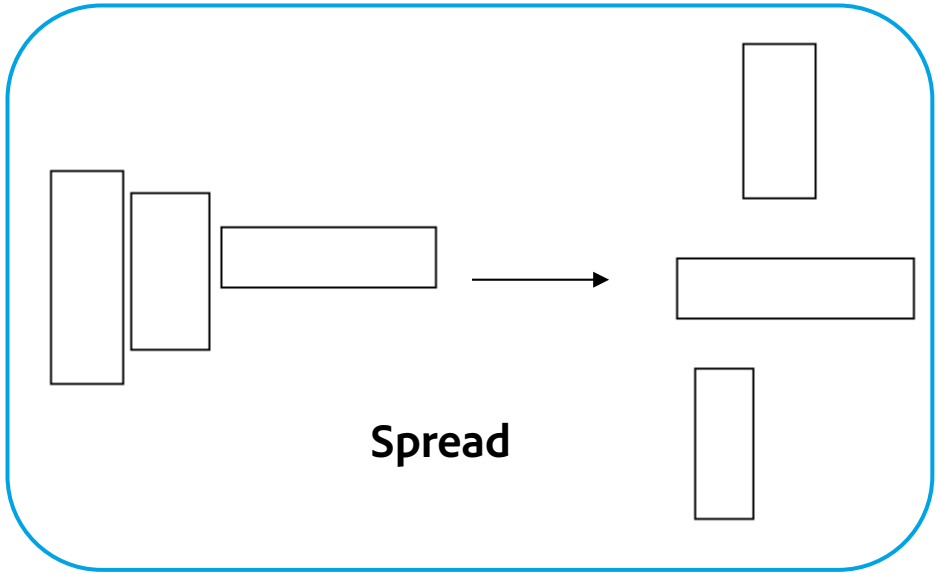
What constitutes a good banner?

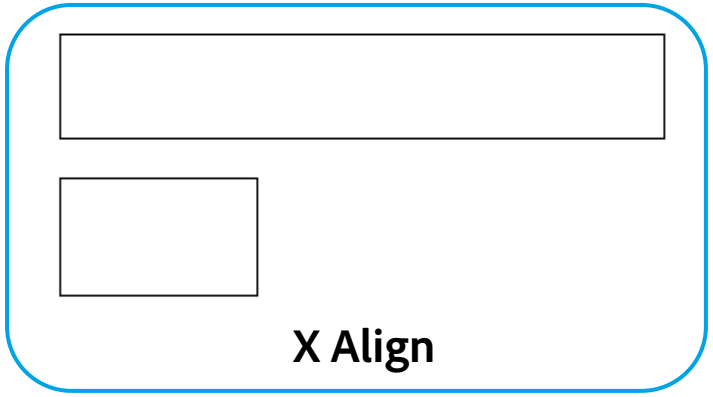
1. Peter O'Donovan, Aseem Agarwala, Aaron Hertzmann: **Learning Layouts for Single-Page Graphic Designs**, IEEE 2014.

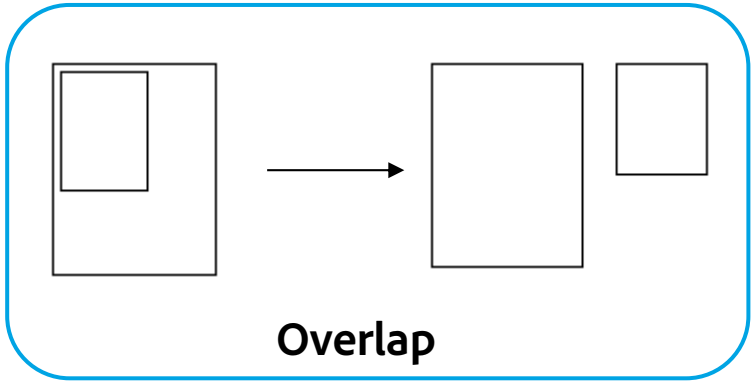
Energy Functions

- Aspects Considered:
  - Alignment
  - Spread
  - Overlap
  - Balance
  - White Space
  - Grouping





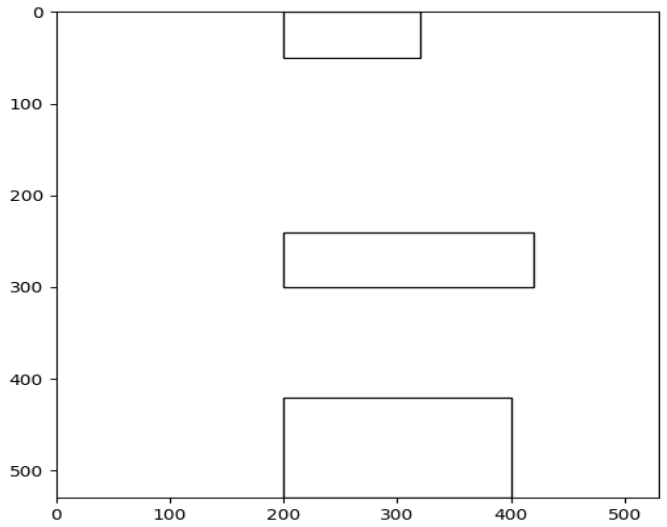




1. Peter O'Donovan, Aseem Agarwala, Aaron Hertzmann: **Learning Layouts for Single-Page Graphic Designs**, IEEE 2014.

Learning Layout

- Different weights are given to different design aspects.
  - **Alignment, Spread, Overlap, Balance, Grouping, Whitespace**
- Overall energy is calculated using the weighted sum of energy functions.



$$G(\theta) = E(\mathbf{X}_T; \theta) - \min_{\mathbf{X}} E(\mathbf{X}; \theta)$$

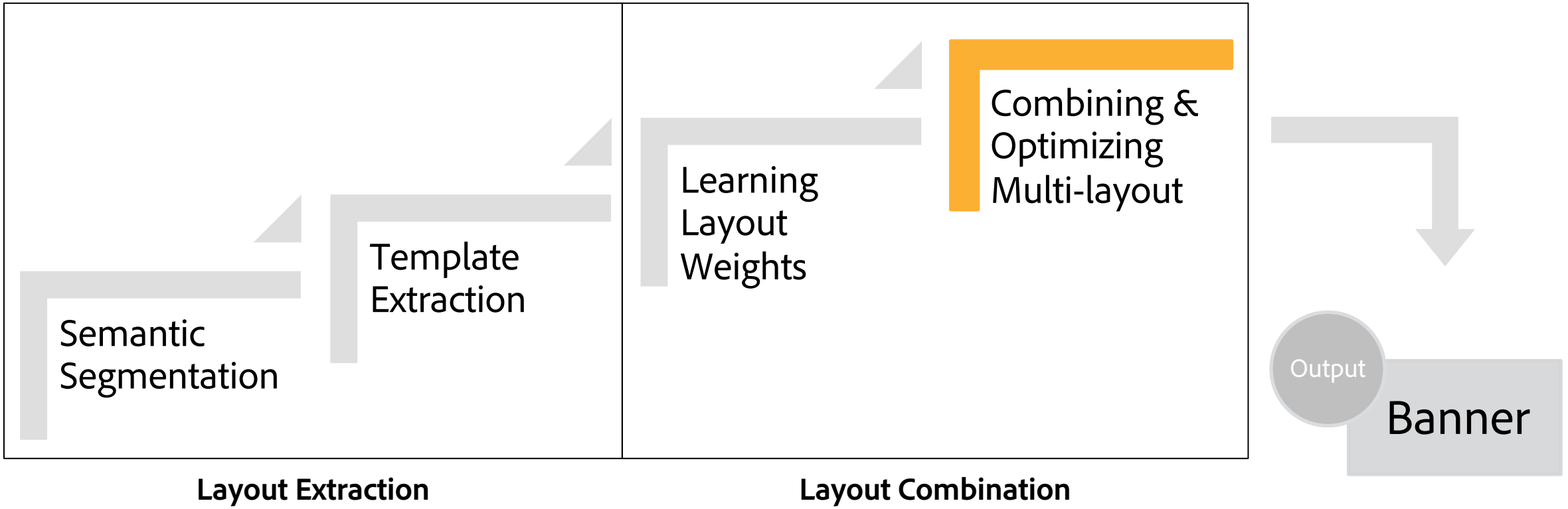
Weights = [10 , 0.2 , 0.7 , 1 , 1 , 0.3 , 1.3 , 2.1 , 1.1 , 0 , 0 , 0]

X Align Weight is high

- Weights are learned using Non-linear Inverse optimization.

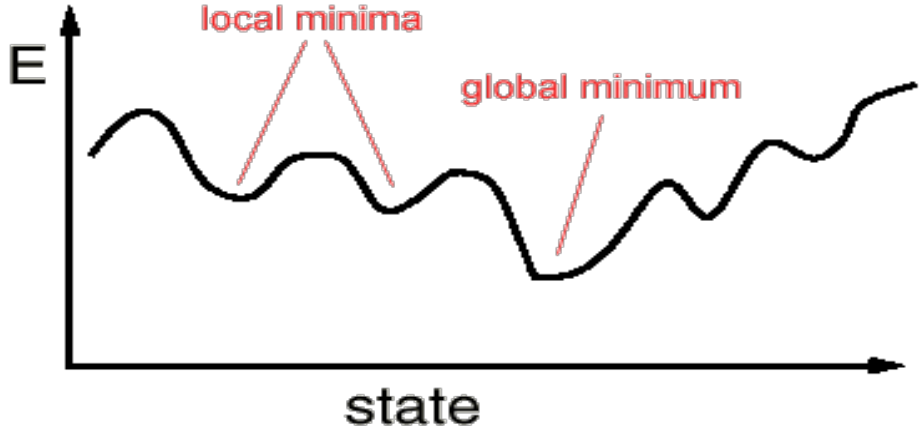
1. Peter O'Donovan, Aseem Agarwala, Aaron Hertzmann: **Learning Layouts for Single-Page Graphic Designs**, IEEE 2014.

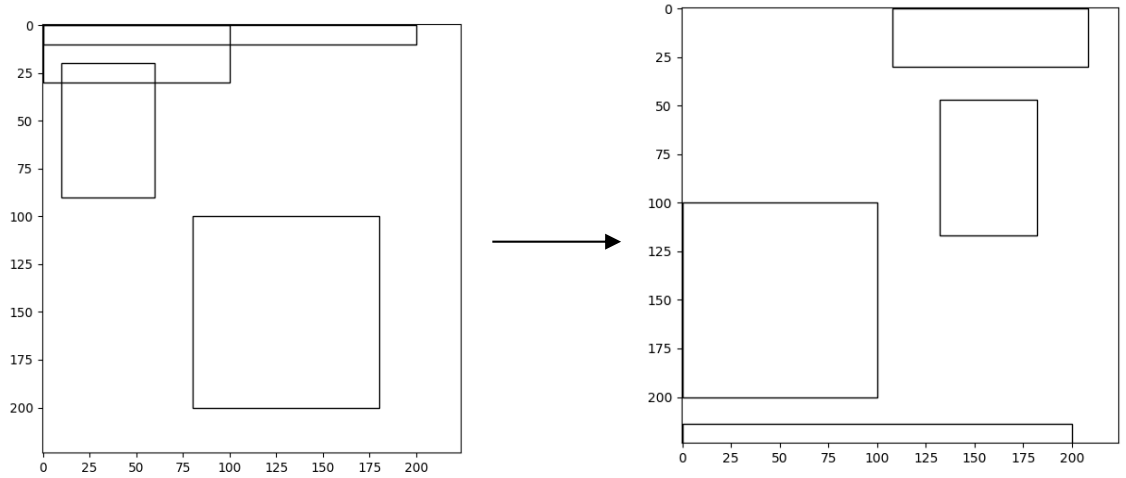
Solution Approach



Optimizing Layout

- Simulated Annealing:
  - Randomly picks elements
  - Use of proposals
  - Checks if layout is better





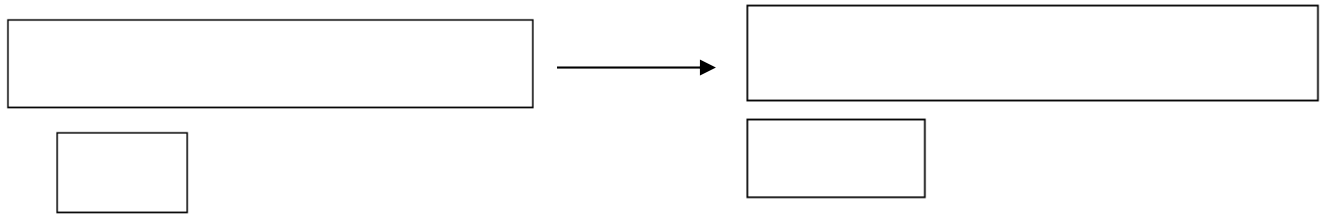
Random Layout

Optimized Layout

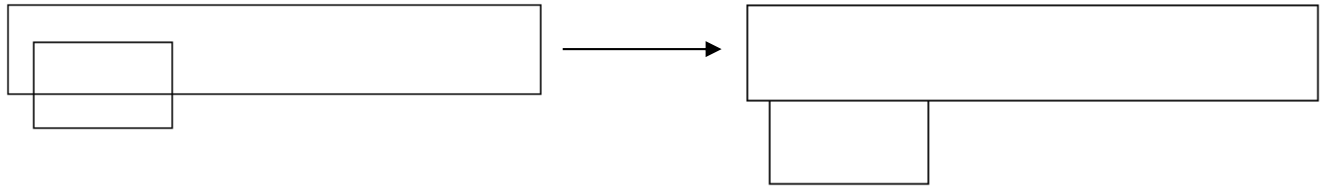
1. Peter O'Donovan, Aseem Agarwala, Aaron Hertzmann: **Learning Layouts for Single-Page Graphic Designs**, IEEE 2014.

Proposals

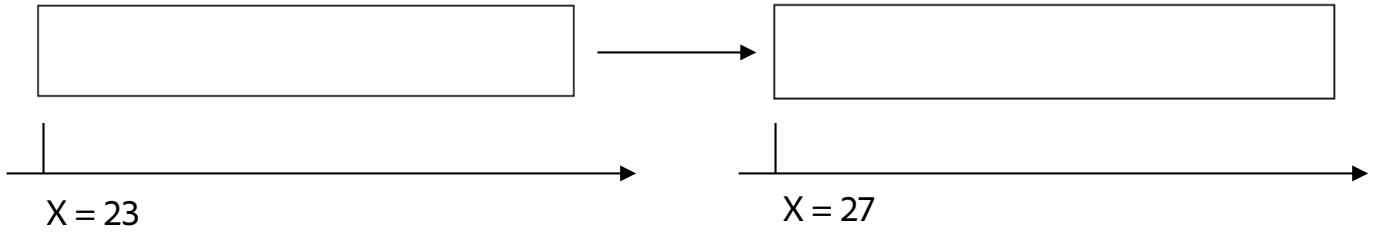
Aligning two elements



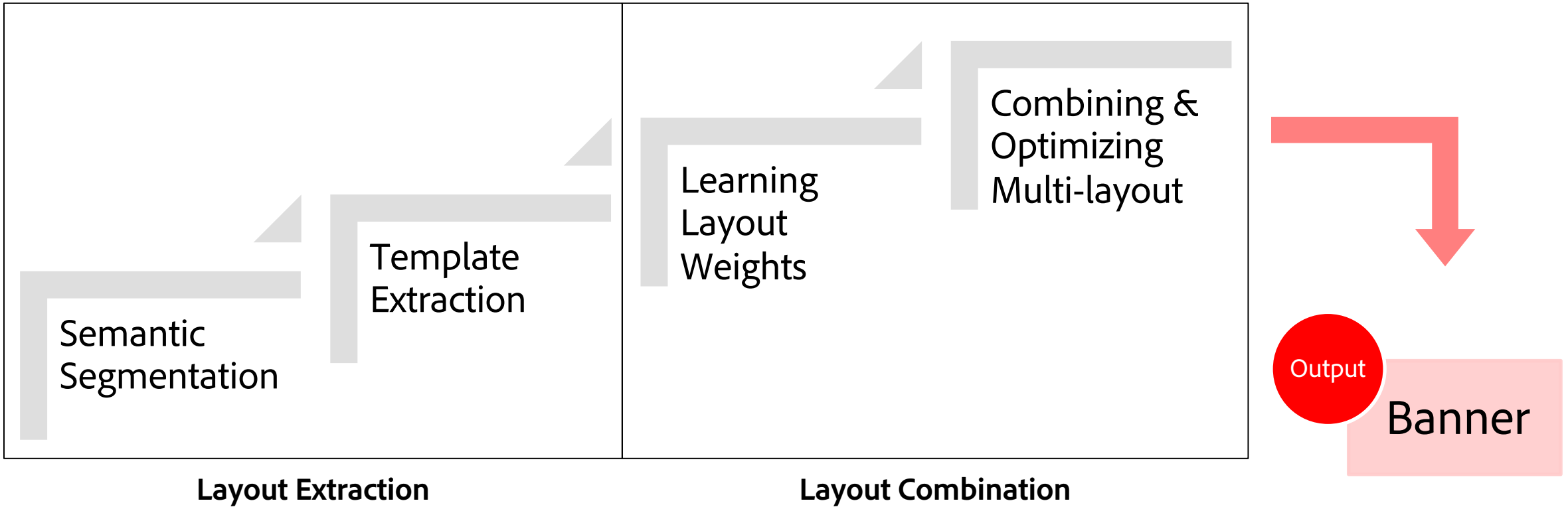
Removing Overlap



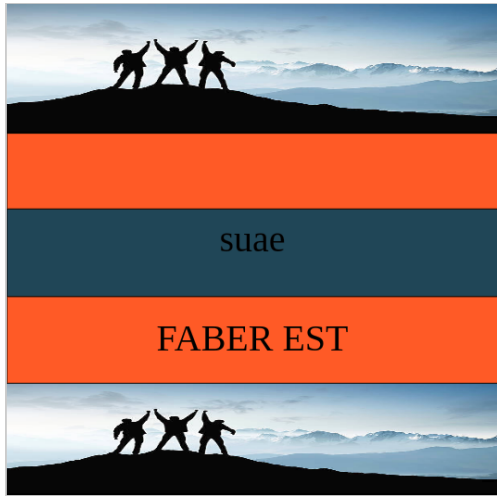
Changing Position

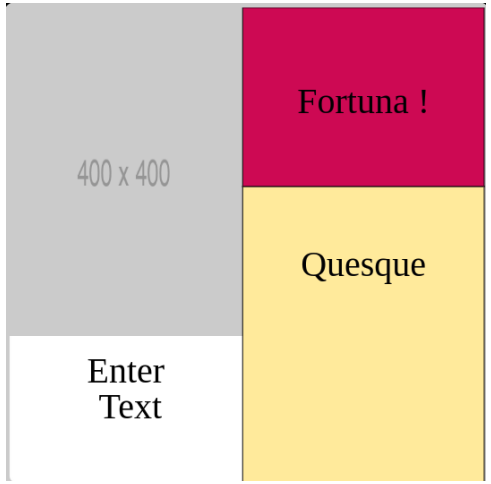


Solution Approach



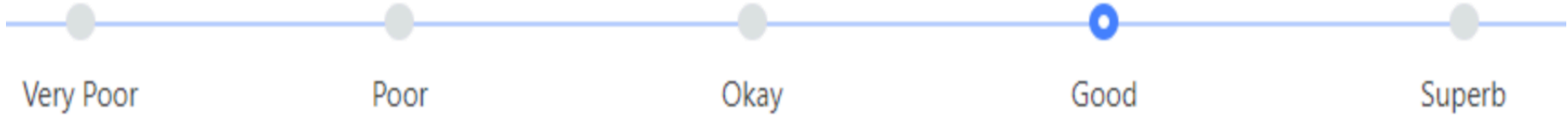
Finally, the Output!





Evaluation layout combination

- A mix of designer-generated and machine-generated banners.
- Mechanical Turk survey where users are shown banners randomly from this mix.
- Users rate various aspect of the banner on a 5-point Likert scale.



Aspect	Alignment	Overlap	Spread	Overall
Designer	3.705	4.093	3.899	4.046
Machine	3.854	3.806	3.806	3.733

Conclusions & Take Away

- Contributions:
  - Automatically extract the template of any banner.
  - Fine-tune the layout with the user's content.
  - Extendable to multiple banners.

- Future Work: Incorporate image and visual saliency for optimization and font prediction

Thank you!!