# Self-Selective Context for Interaction Recognition

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# Problem: Human-object interaction recognition

Fig. 1: Human-object interactions come with many contexts that can help in recognition. In the example above, utilizing the body-parts, the deformation, and the surround scene can ease the recognition of <ride, bicycle>. However, background objects like the boats can mislead the recogniton. In this paper, we first develop novel contextual features, as well as a context selection scheme Self-Selective Context to rely only on the most discriminative contexts.

# Method: Self-Selective Context Module

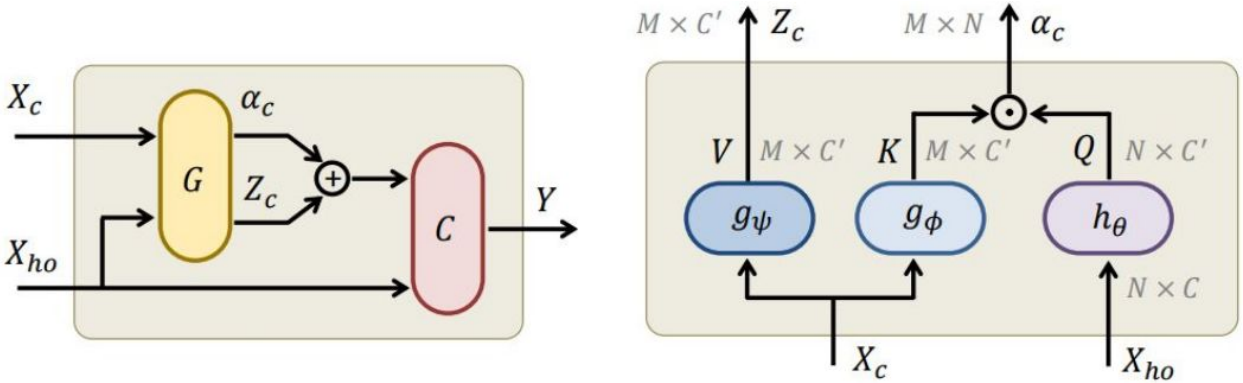



Fig. 2: Overview of our method. On the left, the Self-Selection module. It takes as an input the features $\mathbf{X}_{ho}$ of $N$ human-object pairs in a certain image, and $M$ context features $\mathbf{X}_c$ corresponding to the image. Then, it modulates the context features $\mathbf{X}_c$ using a novel Gating module $G(\cdot)$. The final image-level features are then feed-forwarded to the classifier $C(\cdot)$ to predict the human-object interactions in the image. On the right, the Gating module $G(\cdot)$, inspired by the Self-attention [8]. The main purpose of $G(\cdot)$ is to embed the heterogeneous context features $\mathbf{X}_c$ into a compact representation $\mathbf{Z}_c$. $G(\cdot)$ predicts the vectors $\alpha$ used for Self-Selection of the embedded context features $\mathbf{Z}_c$.

# Method: Proposed Context Features

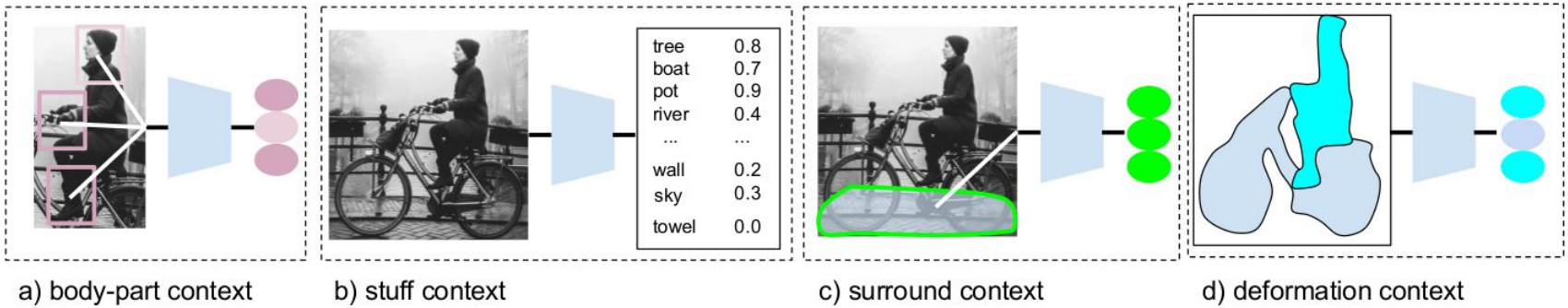



Fig. 3: The context features proposed in this paper. a) Body-part context models the appearance of the human joints, b) Stuff-context models the occurrence of stuff-like regions in the image, c) Surround context models the appearance of local segments around humans, d) Deformation context models the shape of the human-object posture.

# Experiments

Datasets: HICO, V-COCO, CINT (ours)

Evaluation: mAP

# Experiment 1

TABLE I: Self-Selection of The Single Context.

| Context Feature | mAP(%) | Improvement $\Delta \uparrow$ |
|---|---|---|
| Human-Object (HO)-only | 62.50 | - |
| HO + Body-part context | 68.55 | 6.05 |
| HO + Stuff context | 68.20 | 5.70 |
| HO + Surround context | 68.44 | 5.94 |
| HO + Deformation context | 68.30 | 5.80 |

# Experiment 2

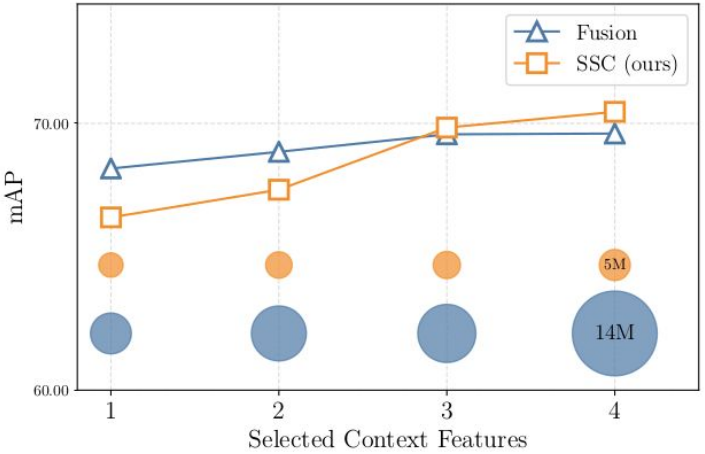
TABLE II: Self-Selection of The Multiple Contexts.

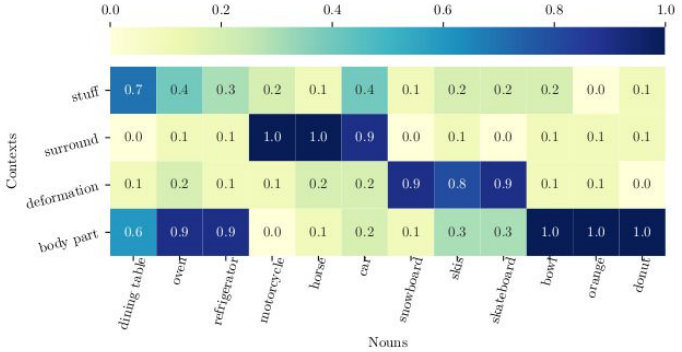
| Method | Dataset | | |
|---|---|---|---|
| | HICO | V-COCO | CINT |
| HO-only | 62.50 | 52.27 | 45.24 |
| HO + Fusion | 69.59 | 54.74 | 49.74 |
| HO + SSC (Ours) | **70.78** | **55.00** | **54.36** |

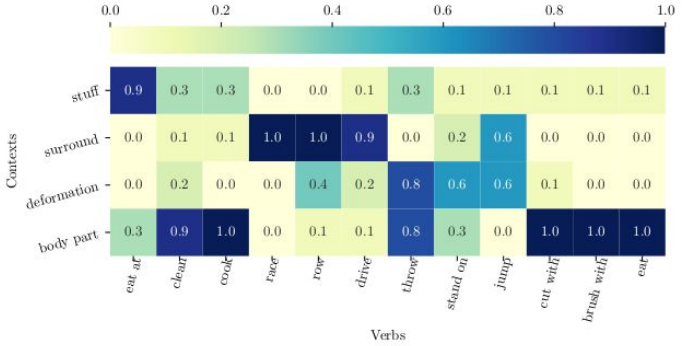
# Quantitative Analysis

TABLE IV: Contribution of Joint Conditioning.

| Condition | Dataset | | |
|---|---|---|---|
| | HICO | V-COCO | CINT |
| context-*only* | 67.77 | 49.58 | 49.26 |
| human-object & context | **70.78** | **55.00** | **54.36** |



# Experiment 3

TABLE V: Combining SSC with the State-of-the-art.

| Method | Dataset | | |
|---|---|---|---|
| | HICO | V-COCO | CINT |
| VGG-16 [16] | 56.10 | 46.91 | 44.83 |
| VGG-16 [16] + **SSC** | **67.59** | **51.17** | **49.56** |
| ContFus [5] | 63.47 | 51.36 | 46.72 |
| ContFus [5] + **SSC** | **65.79** | **52.24** | **51.92** |
| PairAtt [7] | 65.10 | 53.62 | 48.99 |
| PairAtt [7] + **SSC** | **68.29** | **54.24** | **51.22** |
| Human-Object | 62.50 | 51.60 | 47.85 |
| Human-Object + **SSC** | **70.78** | **55.00** | **54.36** |

# Qualitative Analysis

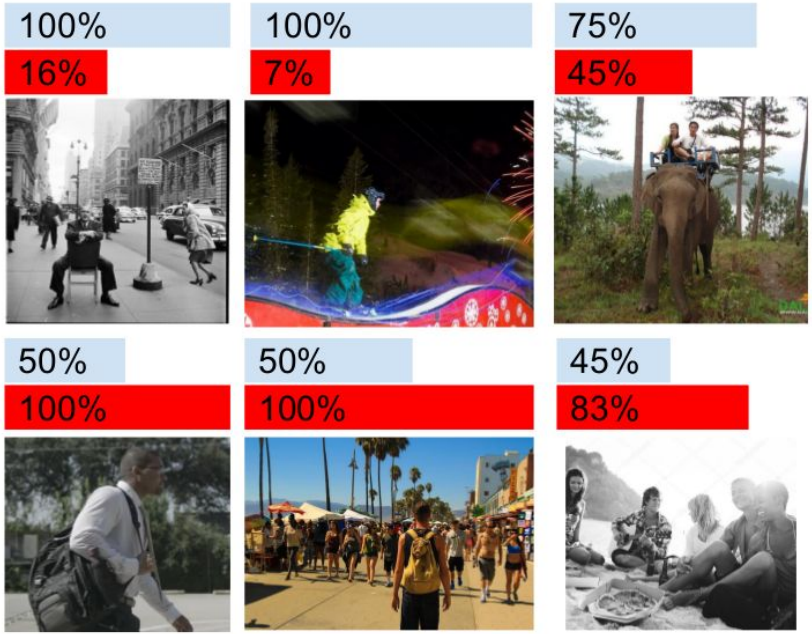



Fig. 6: Qualitative examples from CINT dataset for PairAtt [7] and PairAtt+SSC(ours). We provide mAP % on top for both. SSC helps when the context is unexpected (top), however may decrease the result if the context is not visible or too noisy (bottom).

# Conclusion

This paper tackled human-object interaction recognition from a single image

We treated the task as a context selection task via Self-Selective Context

Experiments on three benchmarks demonstrate the effectiveness of the technique