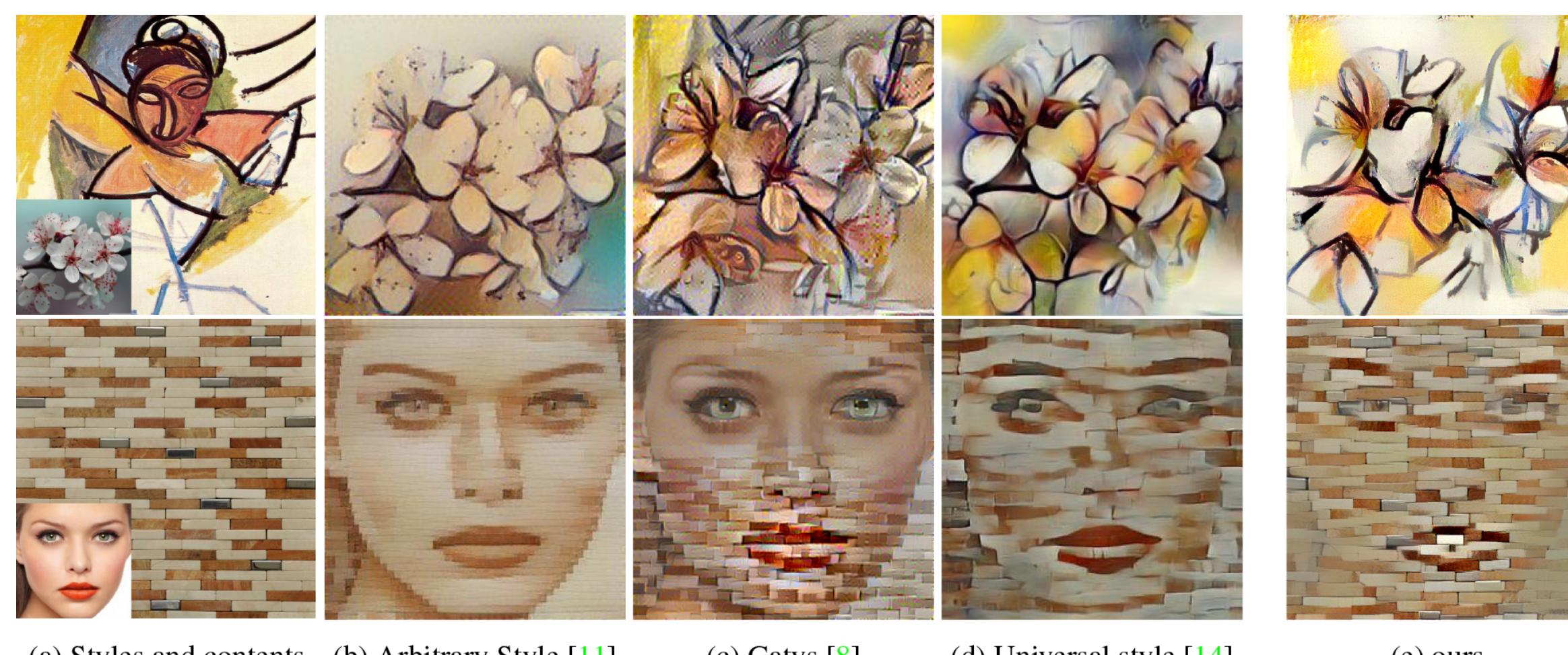


Objective & Motivation



Comparing our method with others

Previous work on Style transfer:

- Gatys et al. (CVPR 2015): Gram matrices from VGG for ST
- Universal ST (NIPS 2017): poor in transferring style

Motivations:

- Instability; losses control between scales; parameter tuning
- How to evaluate the goodness of transferred style?

Contributions:

- Quantitatively evaluate & compare different ST methods
- Cross layer Gram matrices: Solves the instability problem

Methods

Gatys Gram Matrices: within-layer

$$G_{ij}^l(I) = \sum_p [f_{i,p}^l(I)] [f_{j,p}^l(I)]^T$$

Ours Gram Matrices: Cross-layer

$$G_{ij}^{l,m}(I) = \sum_p [f_{i,p}^l(I)] [\uparrow f_{j,p}^m(I)]^T$$

Multiplicative VS. additive loss

- Additive loss (ACG): $L(I_n) = L_c(I_n, I_c) + L_s(I_n, I_s)$.
- Multiplicative loss (MCG): $L(I_n) = L_c(I_n, I_c) * L_s(I_n, I_s)$.

Other Methods

- Gatys + histogram loss (Risser et al. arXiv:1701.08893 (2017))
- ACG + histogram loss
- Universal style transfer

Experimental Setup

- 50 Styles; 200 content Images from Berkeley Segmentation Dataset
- Randomly Sample a triplet of style Image, Content Image and Weight (s, c, w)
- Two dataset: main set & aggressive set

Quantitative Analysis (EC Plot)

Effectiveness

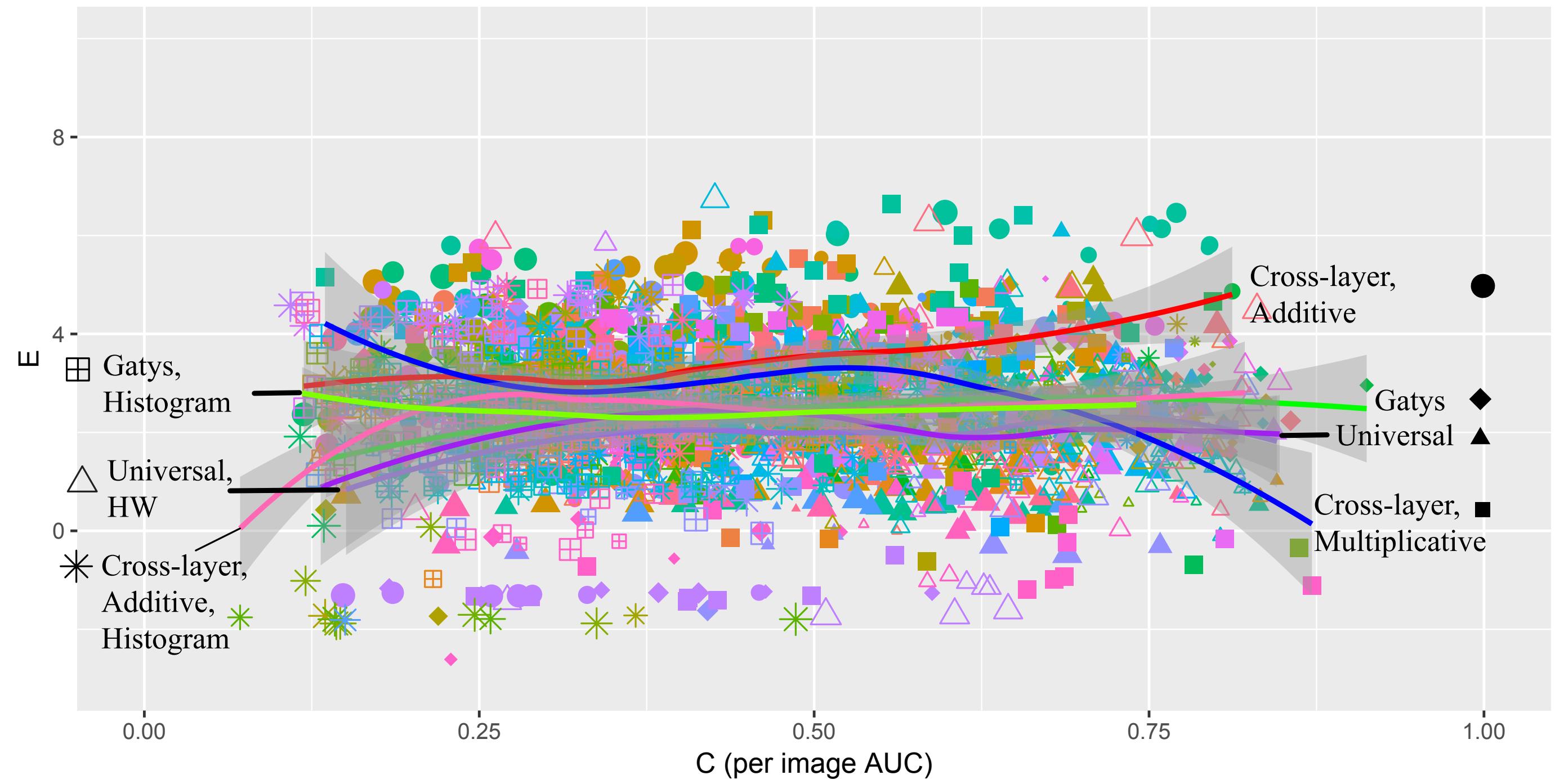
- Evaluate how much original style is preserved after ST
 - Average KL divergence statistics after random projections
- $$E = -\log \left(\frac{1}{R} \sum_k d(\vec{v}_k) \right)$$

Coherence

- Extent to which ST preserves object boundaries.
- Pb: generate probability of boundaries on stylized images, and evaluate on original contour
- C value: Area under curve (AUC) of Pb from precision-recall curve for every synthesized image.

An EC plot comparing style transfers methods.

EC plot comparing seven methods, layer 1

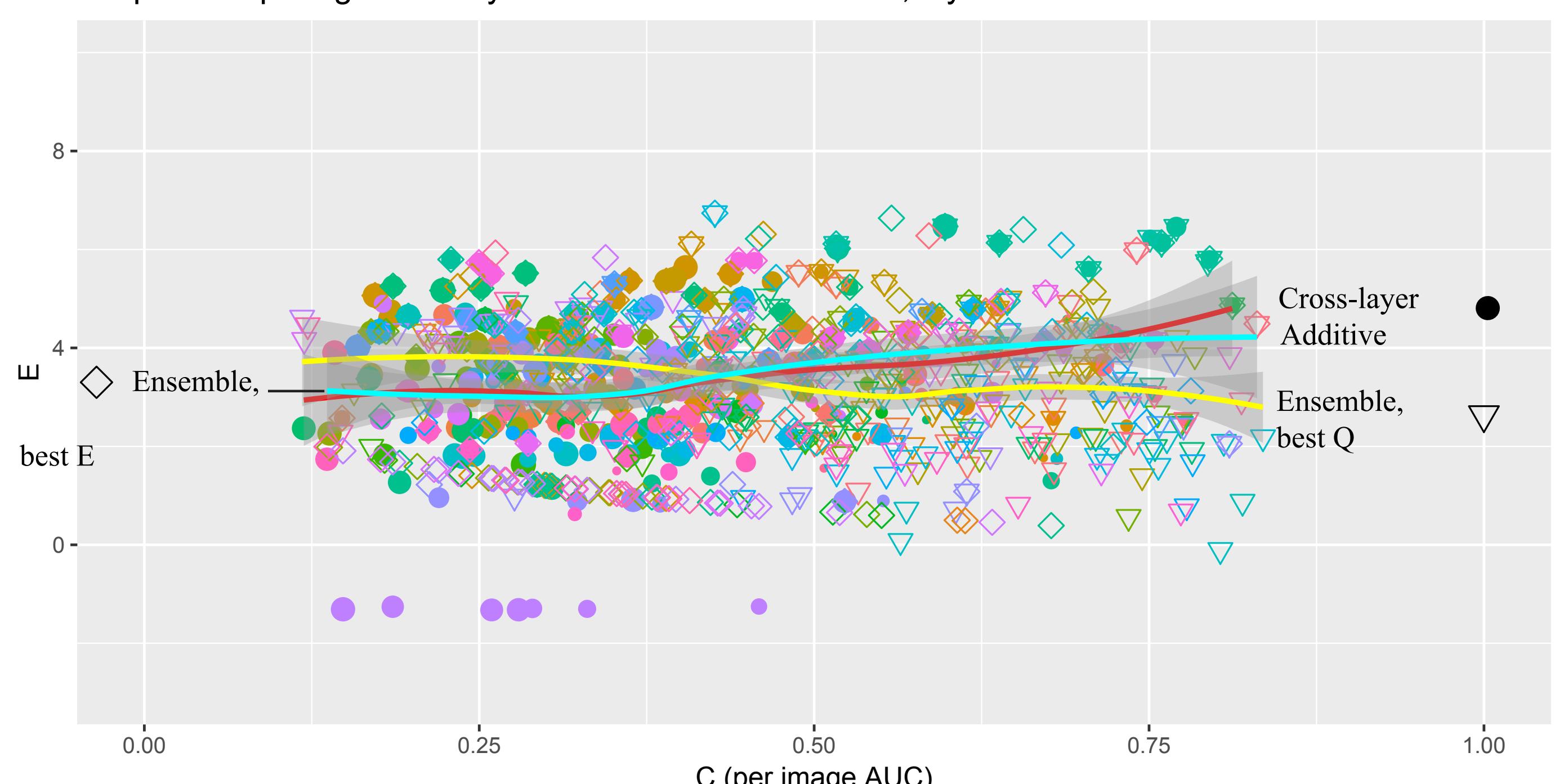


Ensemble Methods

- **Ensemble Q:** Choose that produces best $Q = E * C$ over all methods
- **Ensemble E:** Choose that produces the best E over all methods

An EC plot comparing two ensemble methods to ACG.

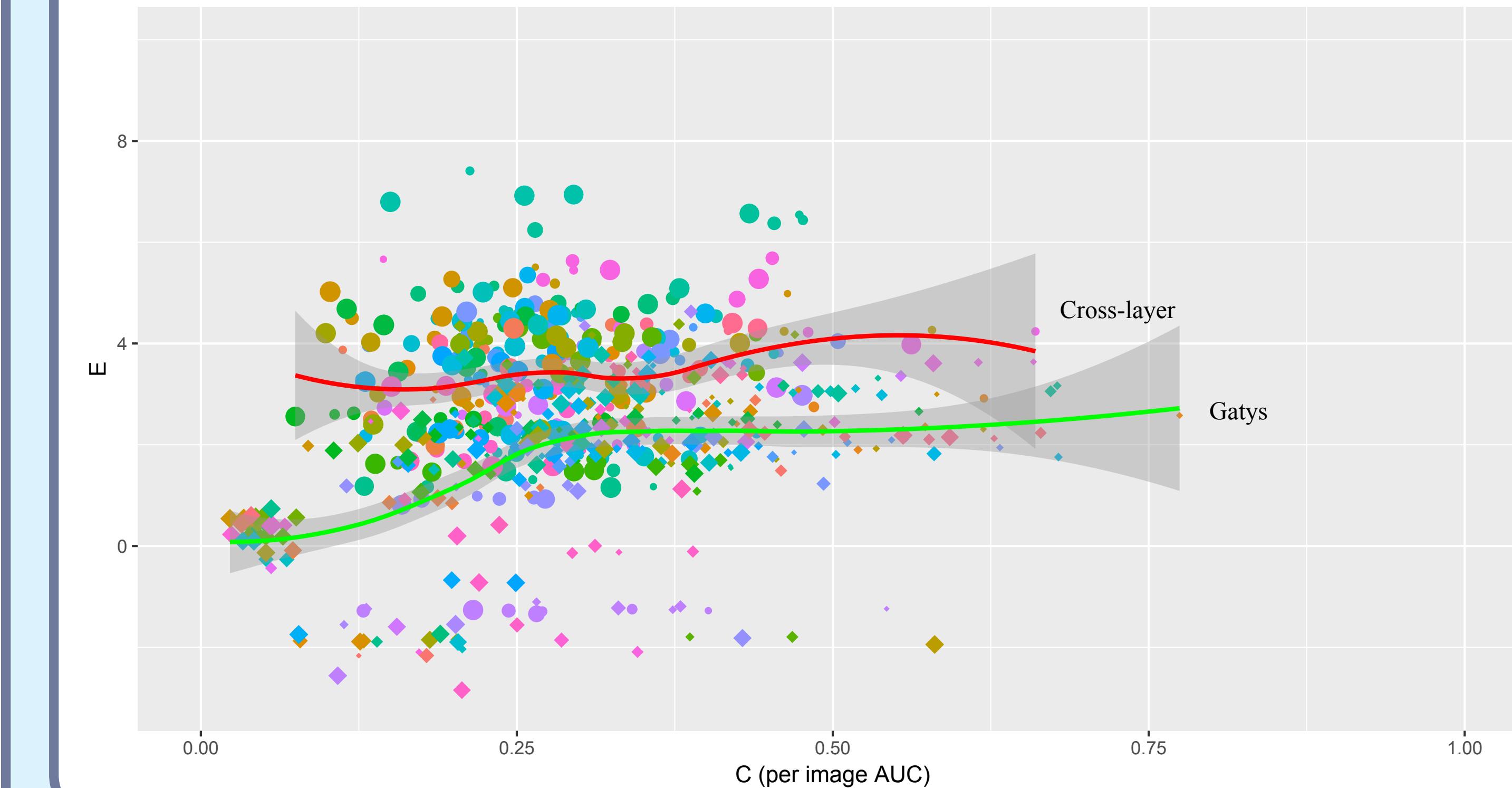
EC plot comparing Cross-layer Additive to 2 Ensembles, layer 1



Aggressive Weighting

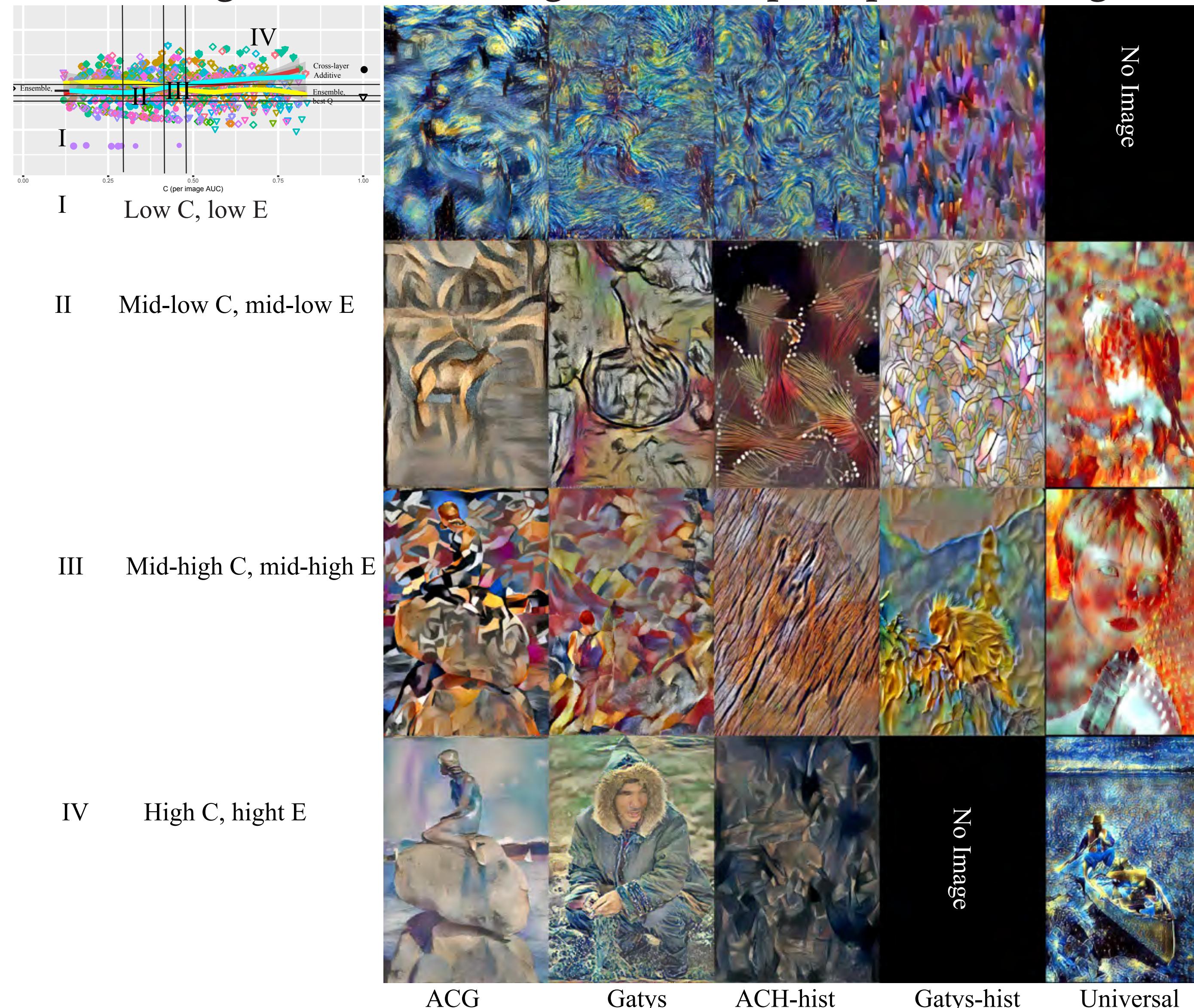
An EC plot comparing Gatys' method to cross-layer style transfer for the aggressive weight dataset.

EC plot comparing Gatys and Cross-layer, aggressive weights, layer 1



Qualitative Analysis (EC Plot)

Anti-Diagonal Medoid image when EC plot split into 4x4 grid



Conclusions

- EC measure seems ideal way to evaluate ST methods
- ACG beats others from both qualitative and quantitative results
- Cross-layer gram matrix do not have same symmetry as Gatys