Estimating Smile Intensity: A better way

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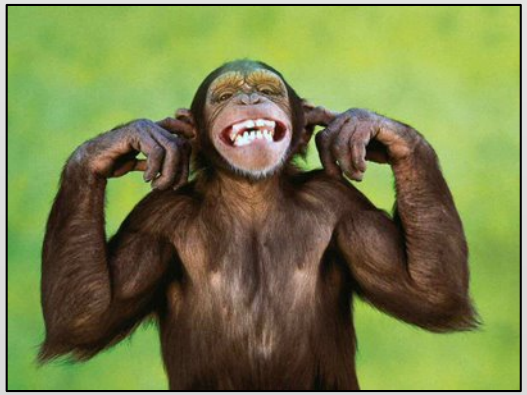
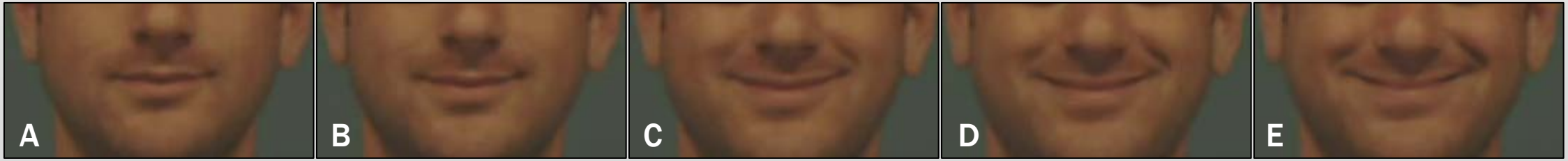
The Whole World Smiles

- Smiles are salient socio-emotional signals
  - Valence, Dominance, Affiliation
- Smiling is linked to psychological phenomena
  - Gender, personality, and culture
  - Health and interpersonal outcomes

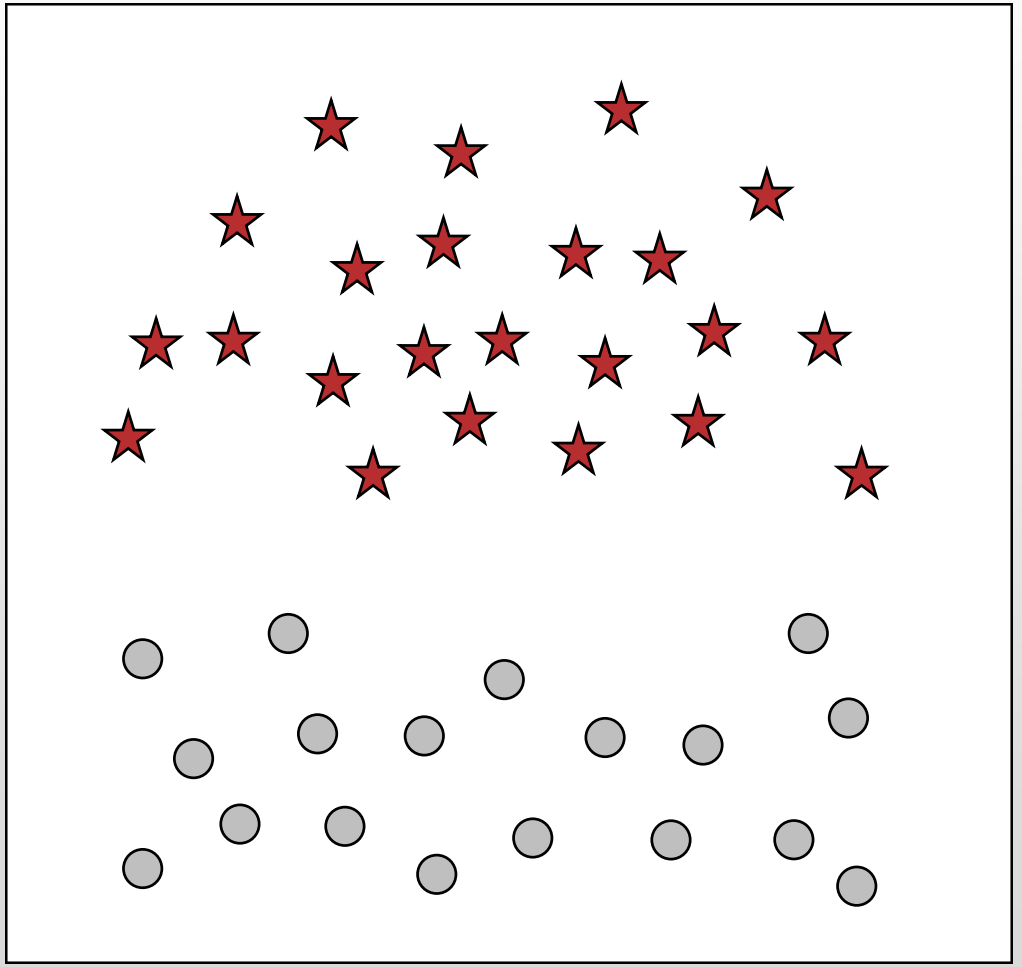
The “Power” of a Smile

- Most researchers have focused on detecting smile occurrence
- The signal value of a smile is highly dependent on its intensity
  - Also important for modeling dynamics
- How can we most efficiently estimate a smile’s intensity?
  - Can existing binary classifiers provide such estimates, …
  - …or do we need to explicitly train models on intensity labels?



Is there a shortcut?

- SVM trained on binary labels



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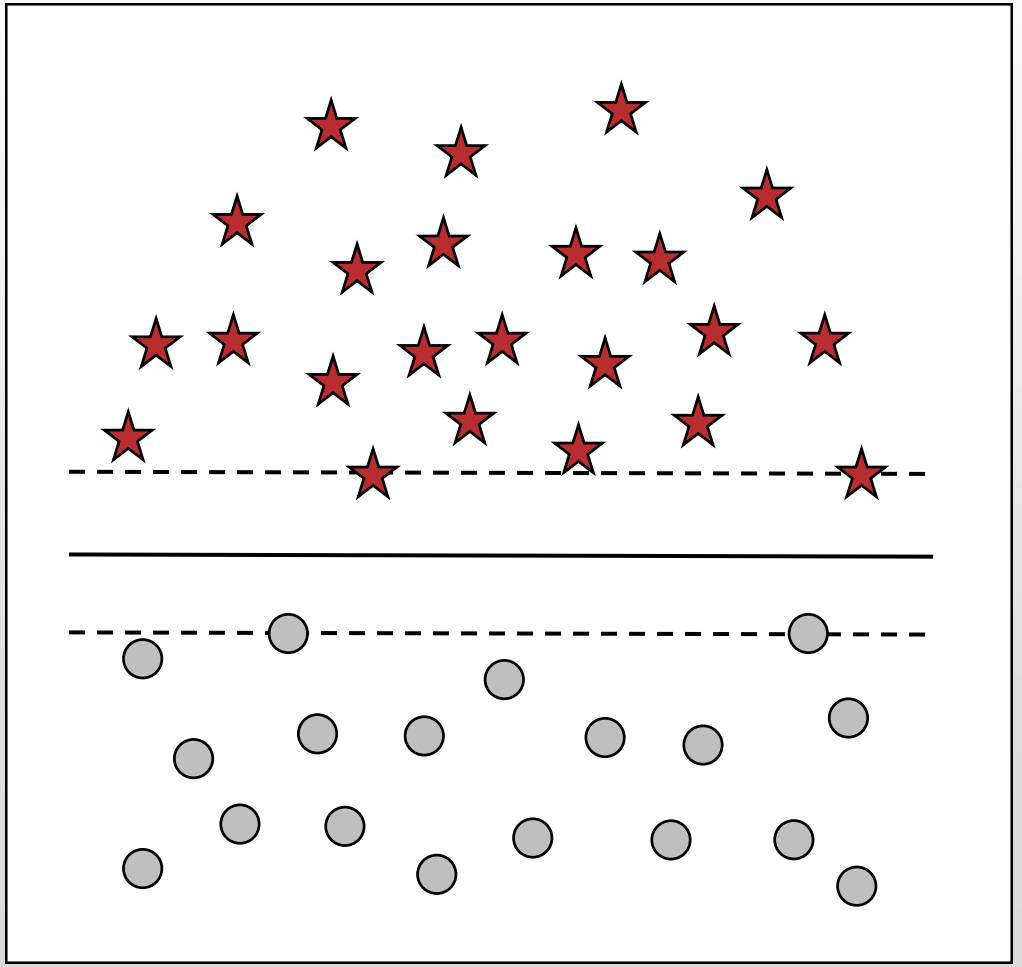
- SVM trained on binary labels
- **Finds the best hyperplane to separate smiles and non-smiles**



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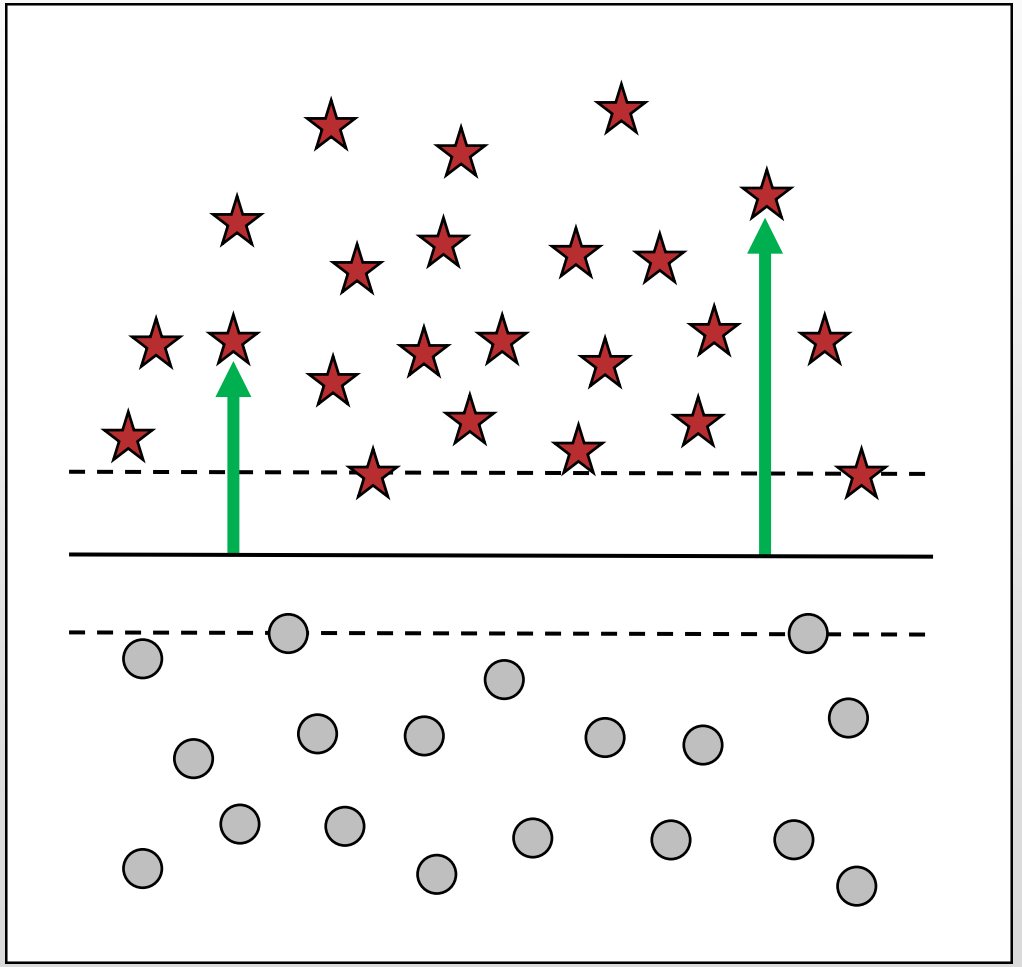
- SVM trained on binary labels
- Finds the best hyperplane to separate smiles and non-smiles
- May estimate smile intensity… assuming higher intensity frames are further from the hyperplane



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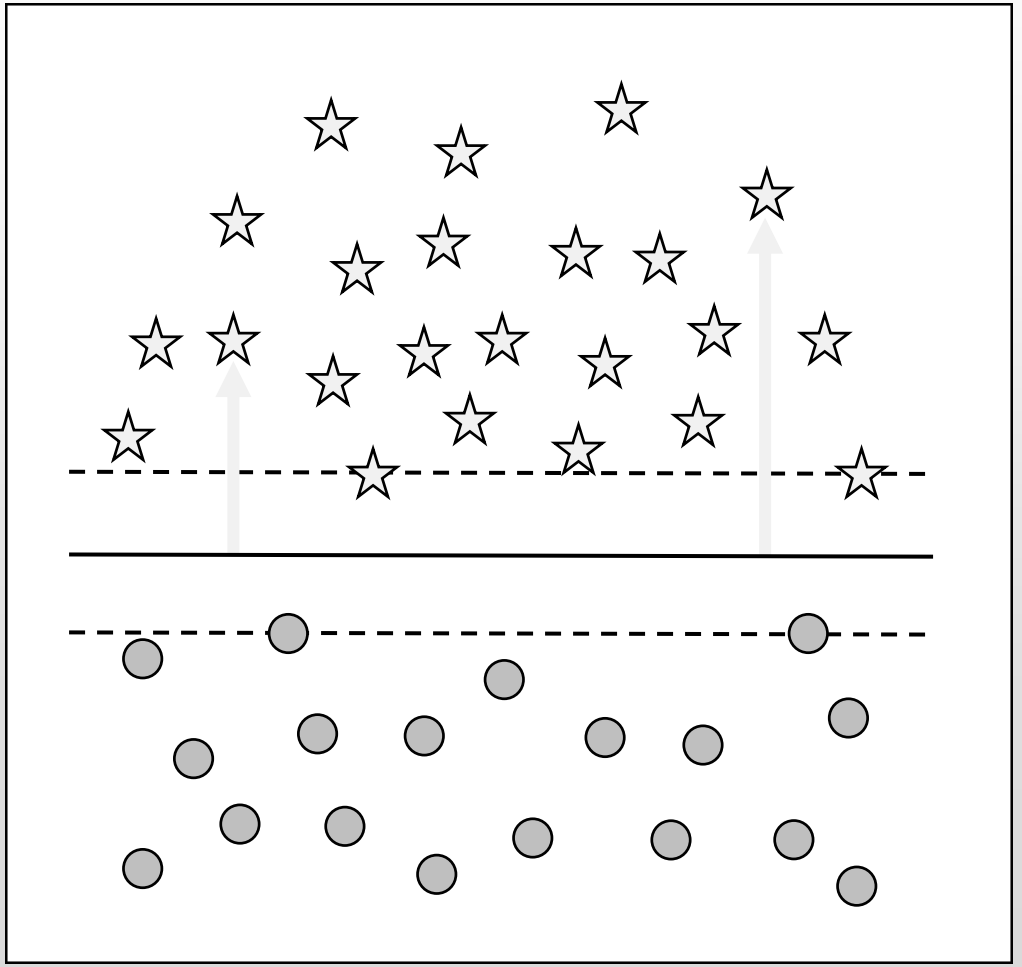
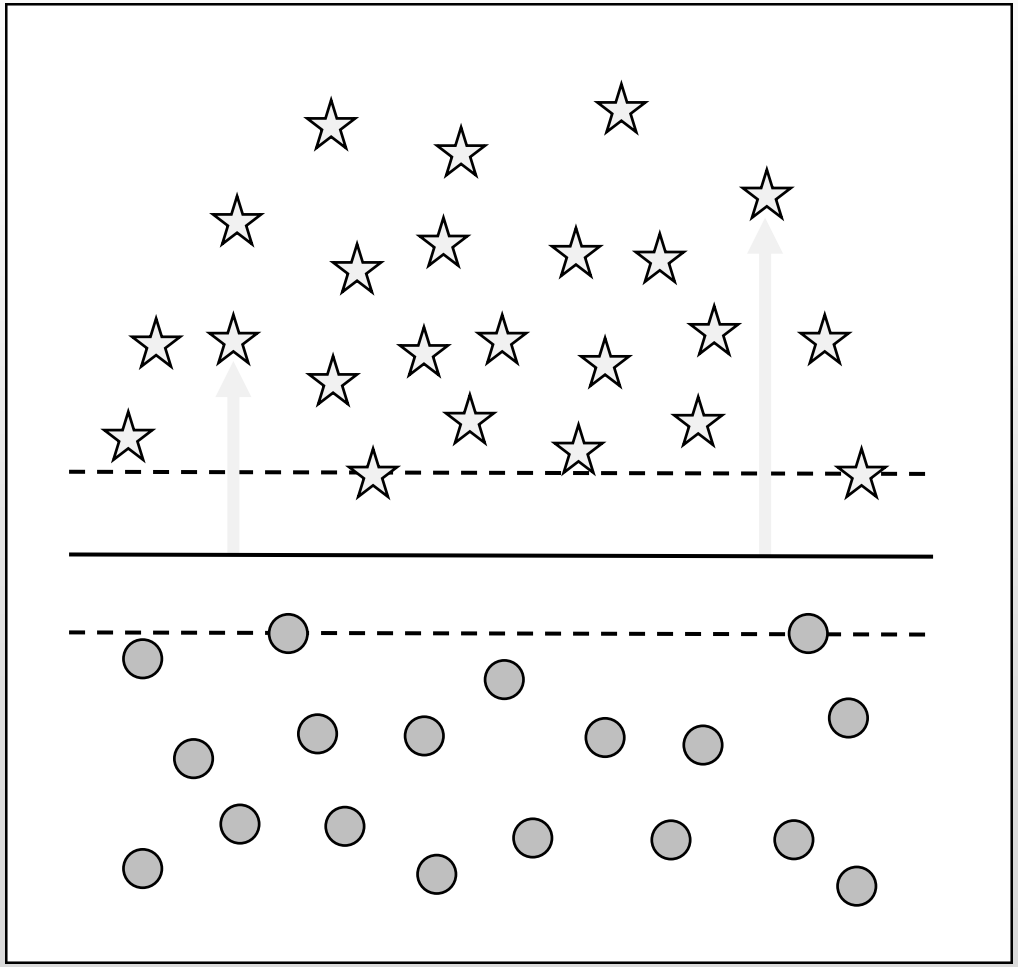


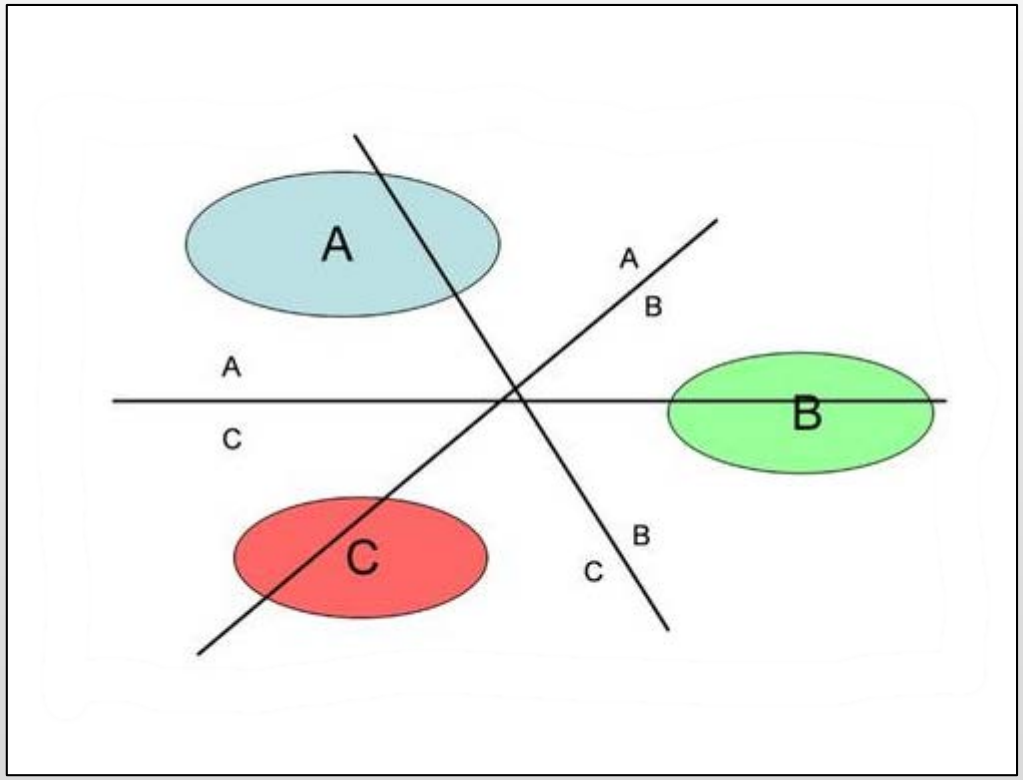
Is there a shortcut?

- SVM trained on binary labels
- Finds the best hyperplane to separate smiles and non-smiles
- May estimate smile intensity… assuming higher intensity frames are further from the hyperplane
- However, nothing in the SVM requires this to be the case, and many factors may influence the distance to the hyperplane

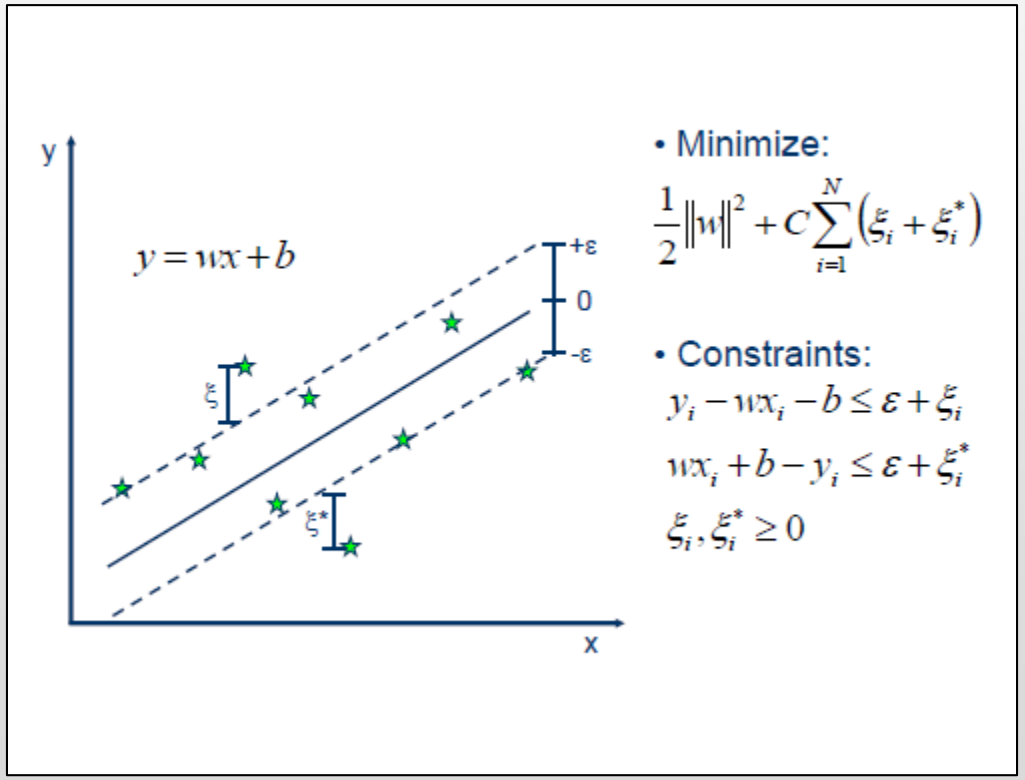


Or is the only road direct?

Multiclass SVM (one-against-one)



Support Vector Regression



Spontaneous Expression Databases

BP4D-Spontaneous Database

- 120,000 frames from 30 participants
- High quality video, high expressiveness
- Expert Coding (F_1 = 0.96; ICC = 0.92)

Spectrum Depression Database

- 200,000 frames from 33 participants
- Highly challenging, psychiatric context
- Expert Coding (F_1 = 0.71; ICC = 0.92)

Methods for Expression Analysis

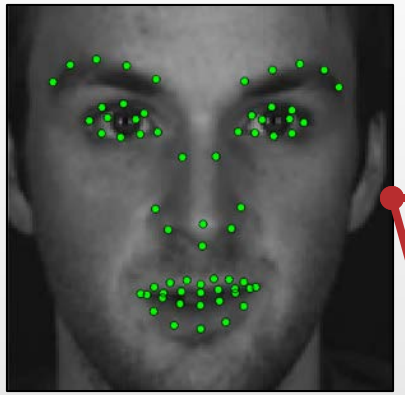
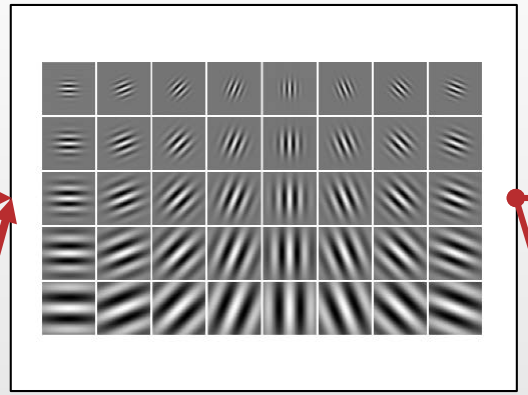
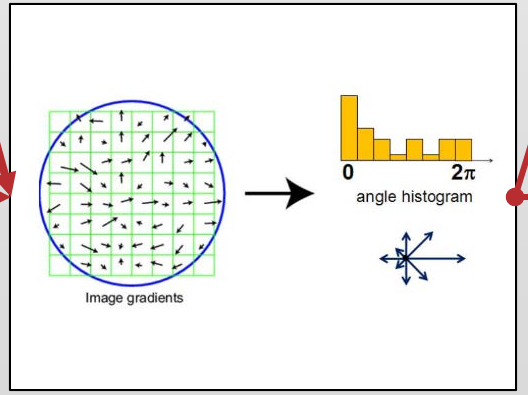


Image Metrics

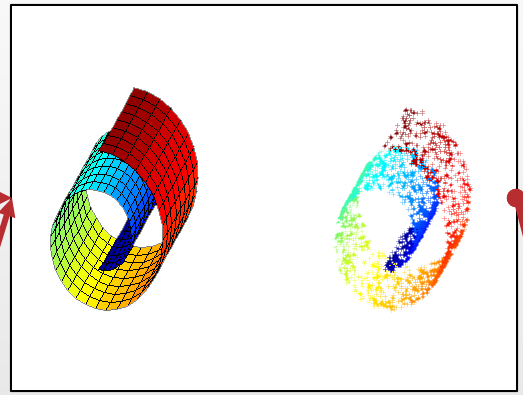
Mathew's AAM



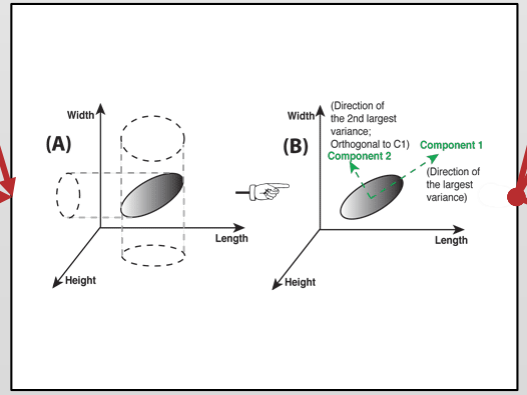
Localized Gabor



Localized SIFT



Laplacian Eigenmap



Linear PCA

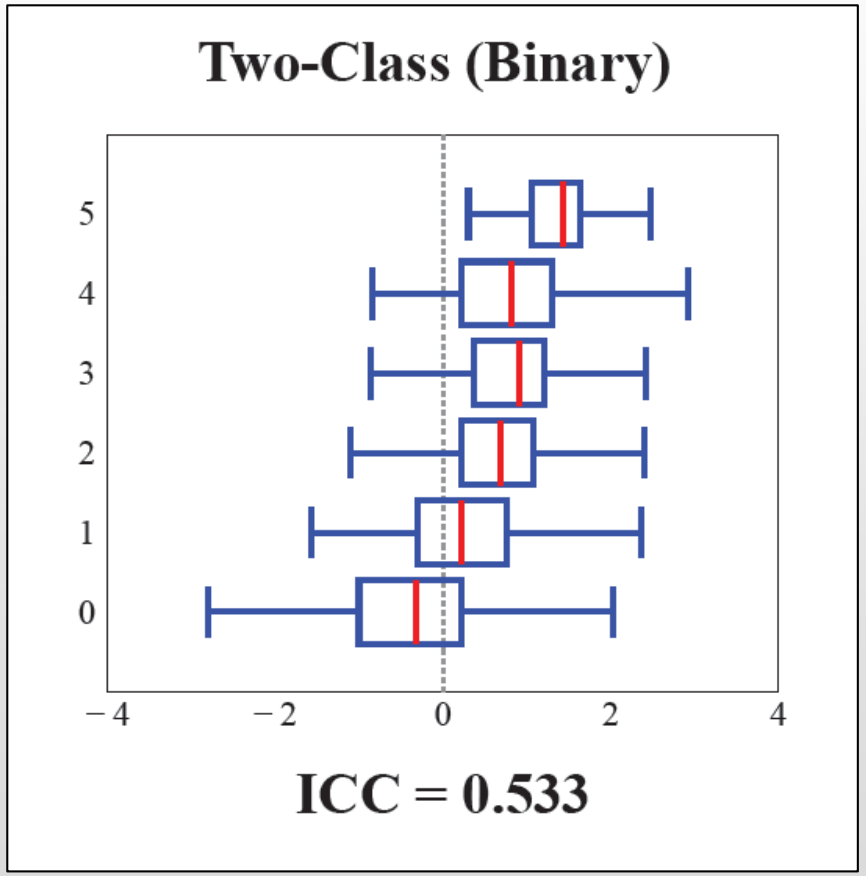
Two-Class (Binary) SVM

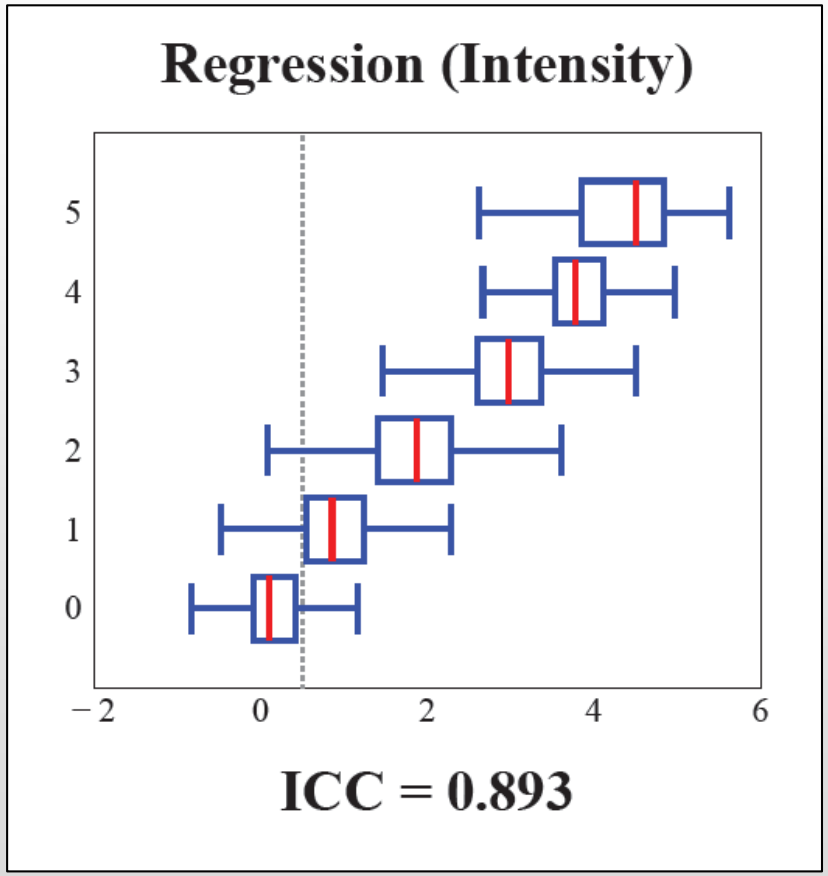
Multiclass (Intensity) SVM

Regression (Intensity) SVR

Average Performance Across Methods

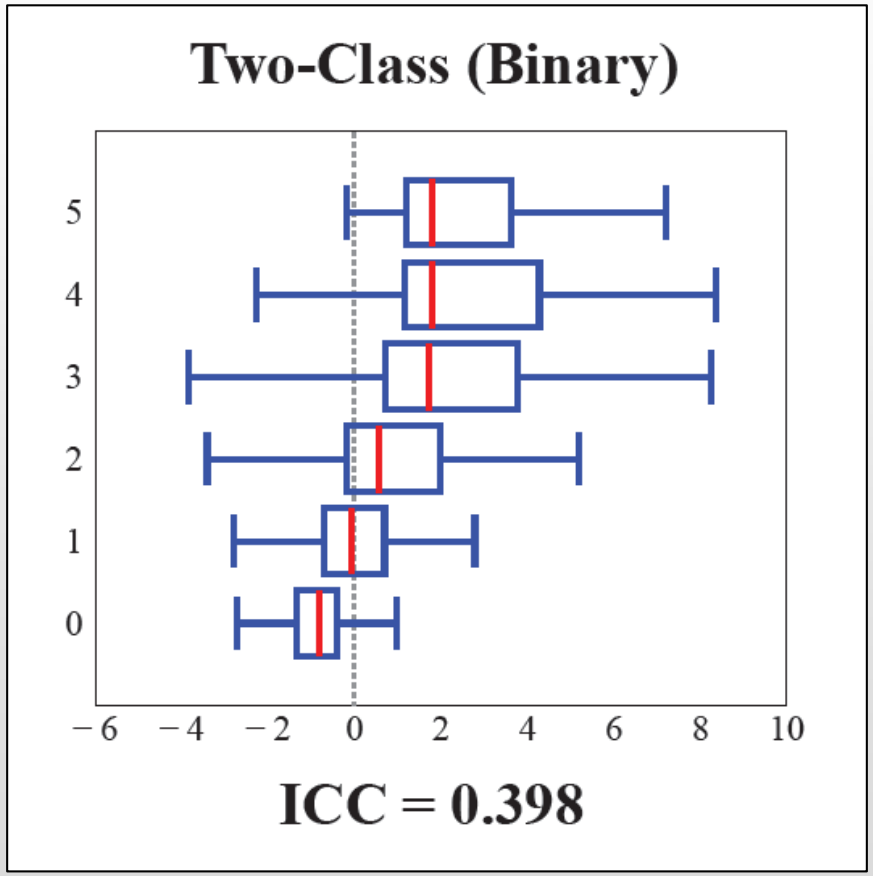
Intensity Level Separation in BP4D

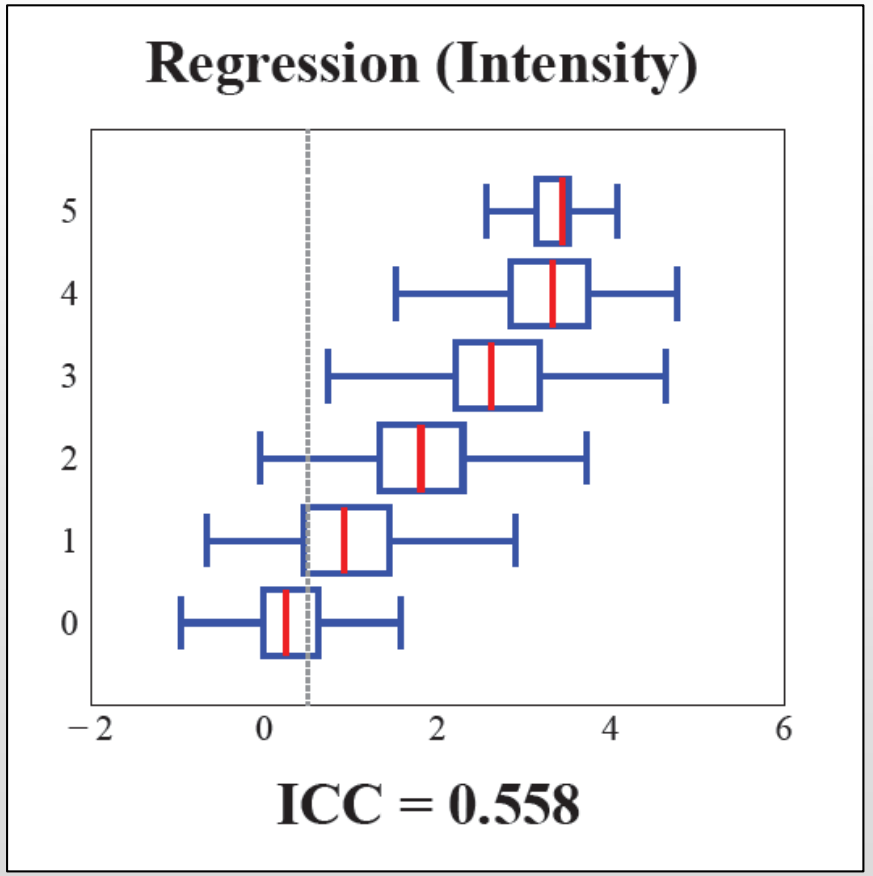




Blue Box = 25th to 75th percentile, Red Line = Median, Blue Lines = 1.5 x IQR

Intensity Level Separation in Spectrum





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Intensity Estimation Demo

Intensity Estimation Demo

Conclusions

- Distance to the hyperplane did not yield competitive performance
- Multiclass and regression models far outperformed this shortcut
- There is no substitute for training on intensity ground truth labels
- Research would benefit from moving beyond binary models of smiling

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http://tinyurl.com/smileintensity