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Universidade Vigo

Single- and Cross- Database Benchmarks for Gender Classification Under Unconstrained Settings

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BeFIT, Barcelona,
November 13, 2011

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Outline

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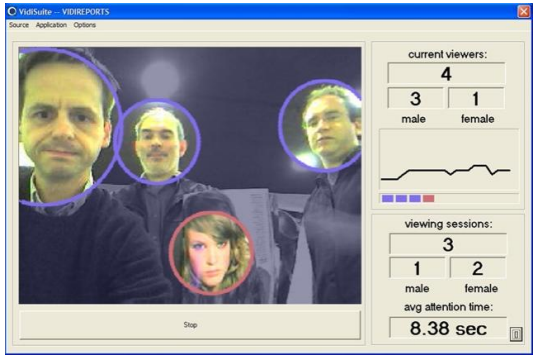
1. Motivation
2. Databases
3. Proposed system
4. Test protocol
5. Results
6. Conclusions

Motivation

- Increasing application areas for gender recognition
  - Realistic performance estimation
- No standardized evaluation protocols
  - Check suitability of different “real-world” databases



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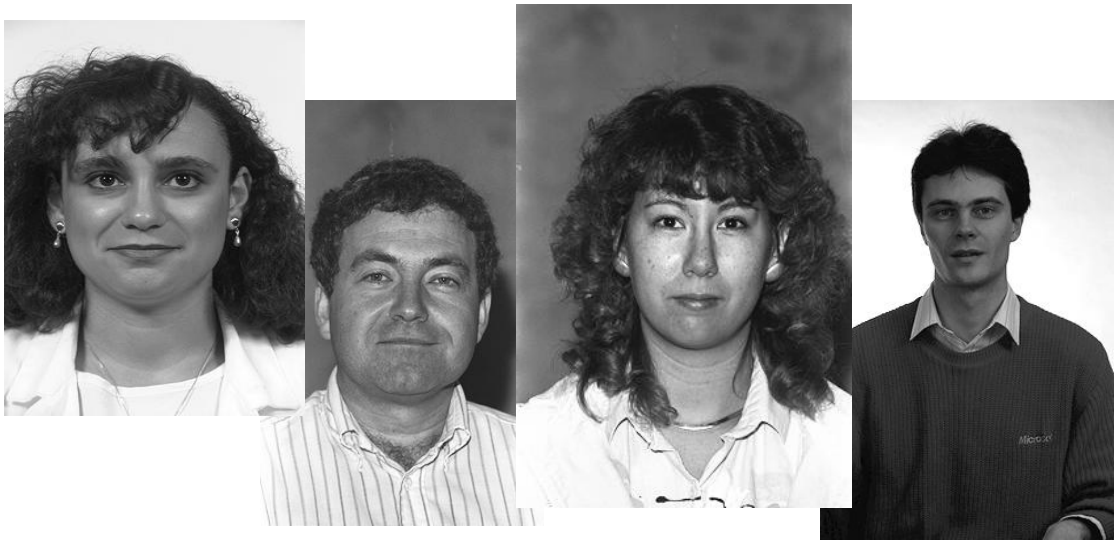
Databases

- FERET Database
  - Controlled conditions
  - Limited demography
  - Small number of images



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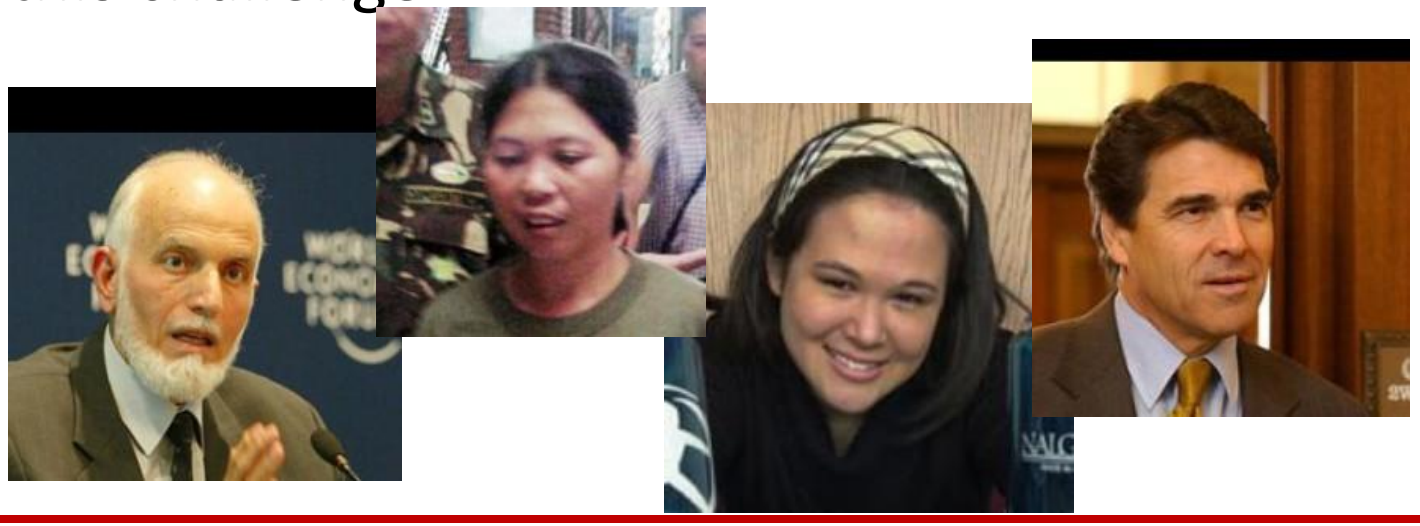
Databases

- LFW Database
  - Large database
  - Commonly used for face recognition
  - Benchmark for gender classification proposed for this challenge



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Databases

- Gallagher's Database
  - Demographic variability
  - Different environments and conditions
  - Very large database





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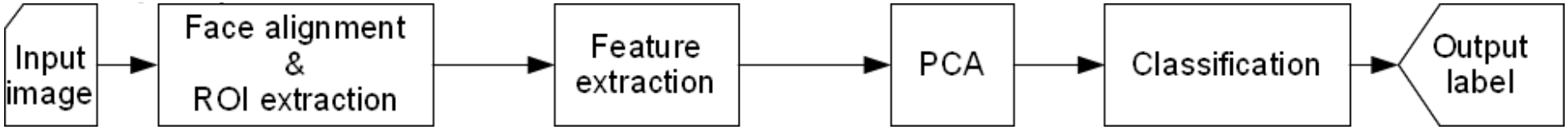
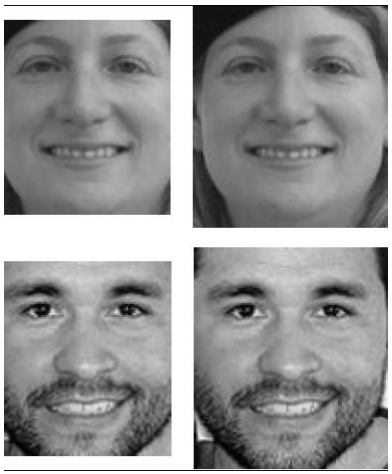
Proposed system



- 90x105
- 105x120



Features
- Pixels
- Gabor jets
- LBPs

Energy %

Classifier
- Linear SVM
- LDA

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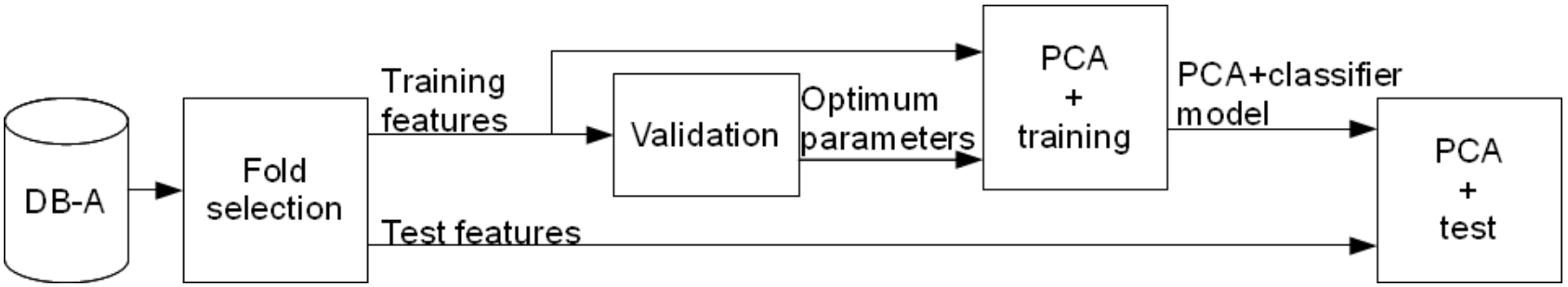
Evaluation protocol

- 5- fold division (following BeFIT Gender Classification challenge)
  - LFW: 10129 male and 2959 female faces
  - Gallagher's: 7380 male and 7380 female faces

Single-Database protocol



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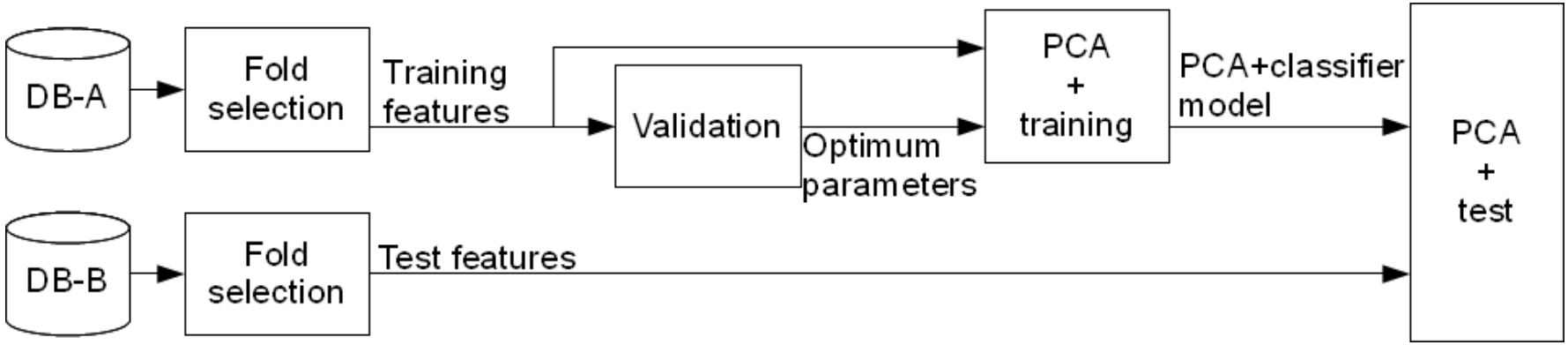
Evaluation protocol

Cross-Database protocol



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Evaluation protocol

- Metrics:

$$ACC = \frac{TP + TN}{P + N} \qquad TPR = \frac{TP}{P} \qquad TNR = \frac{TN}{N}$$

- Tests:
  - Gallagher's → Gallagher's
  - LFW → LFW

  } Single-Database

  - Gallagher's → LFW
  - LFW → Gallagher's

  } Cross-Database

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Results

Gallagher's → Gallagher's

		Pixels		Gabor jets		LBPs	
		90x105	105x120	90x105	105x120	90x105	105x120
PCA+SVM	ACC	77.50	78.81	85.54	86.46	83.86	86.15
	TPR	76.57	77.28	85.87	86.61	83.13	85.91
	TNR	78.43	80.35	85.20	86.31	84.59	86.38
PCA+LDA	ACC	77.42	78.05	84.91	86.09	83.39	85.08
	TPR	75.91	76.42	85.61	86.22	82.63	84.89
	TNR	78.93	79.68	84.20	85.96	84.16	85.27

- Similar behaviour of SVM and LDA
- Best configuration: 105x120 ROI, Gabor jets
- Balanced TPR and TNR

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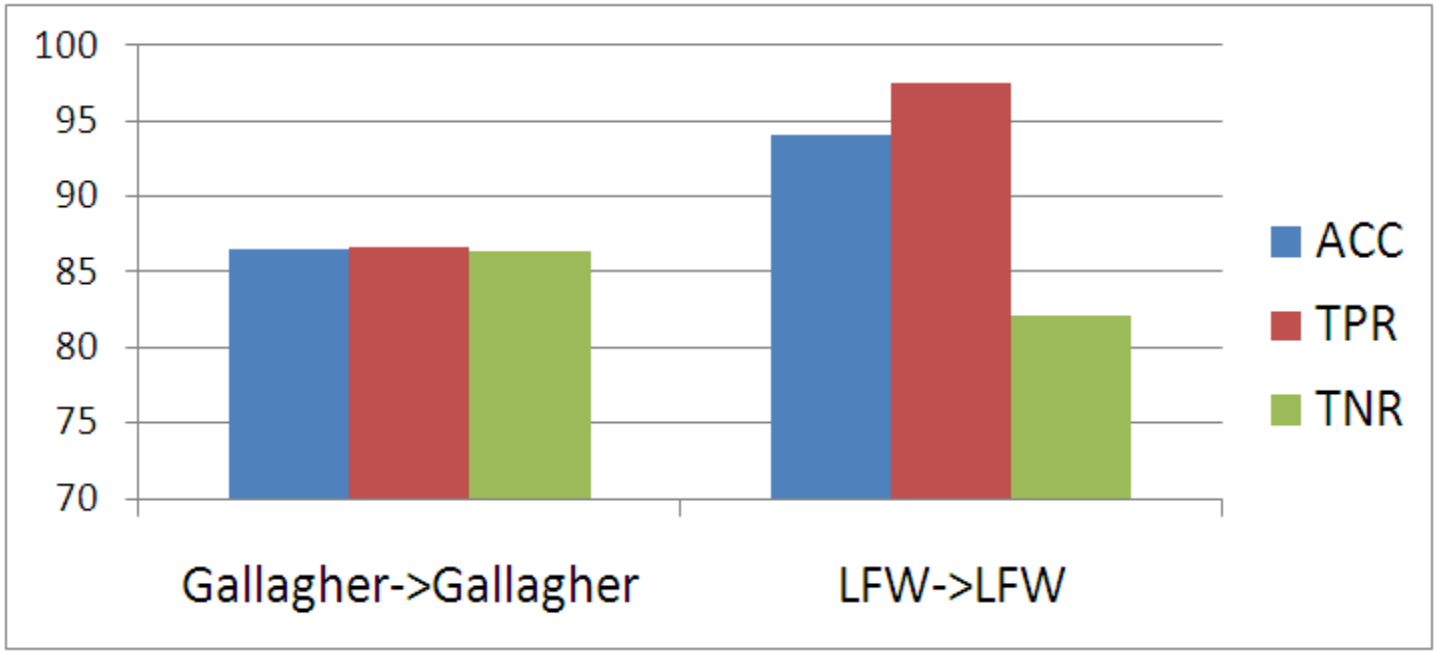
Results

LFW → LFW



- Higher ACC rates
- Great TPR-TNR imbalance

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Results

LFW → LFW

- Similar ACC rate
- More balanced TPR and TNR
- More parameters to determine

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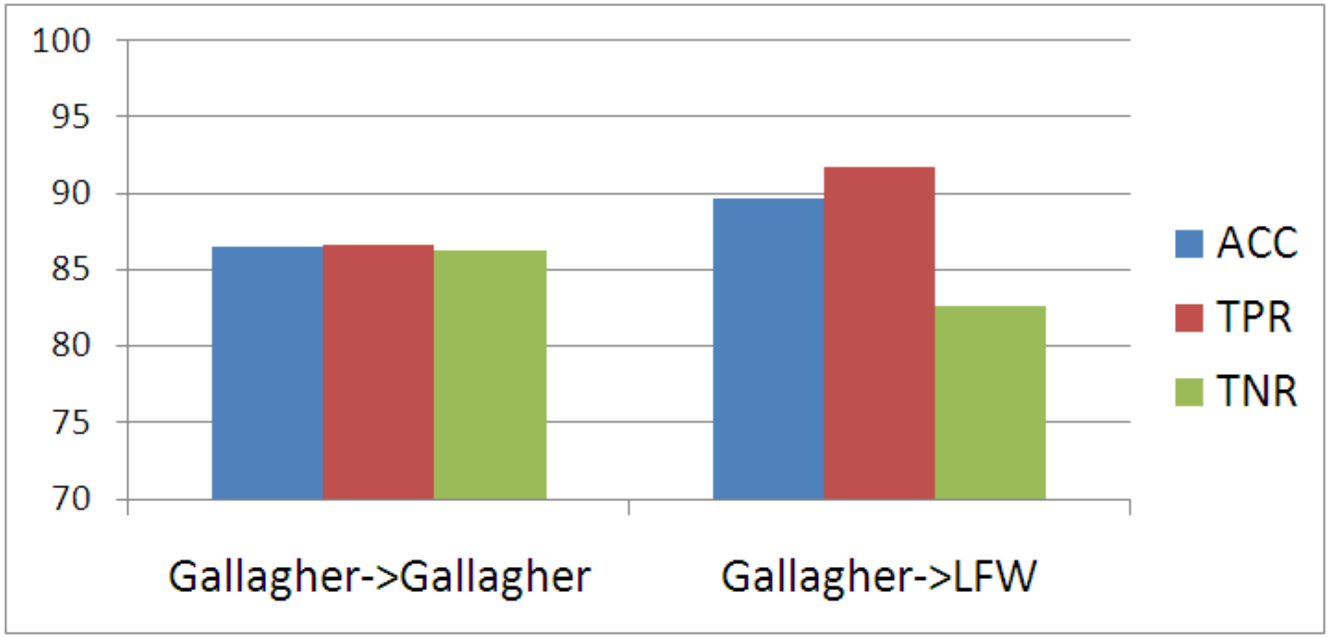
Results

Gallagher's → LFW



- Higher ACC than intra-Gallagher
- TPR-TNR imbalance (9% difference)

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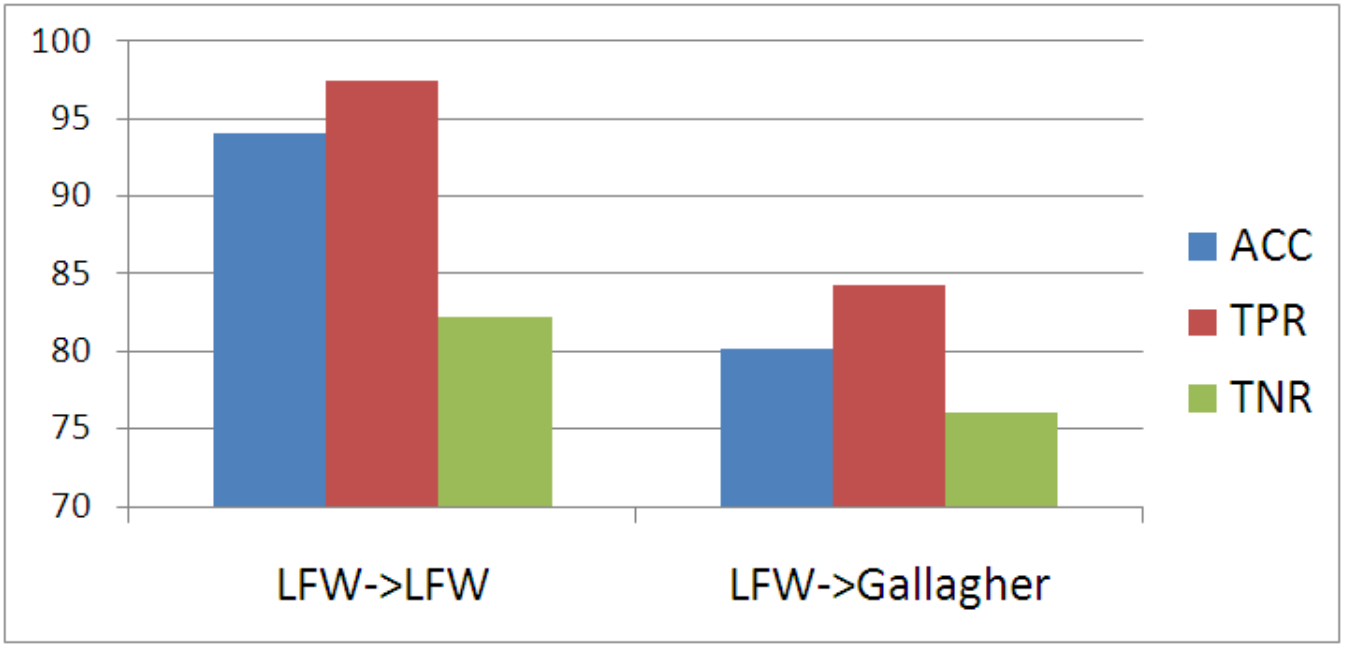
Results

LFW → Gallagher's



- Lower ACC than intra-LFW tests
- TPR-TNR imbalance

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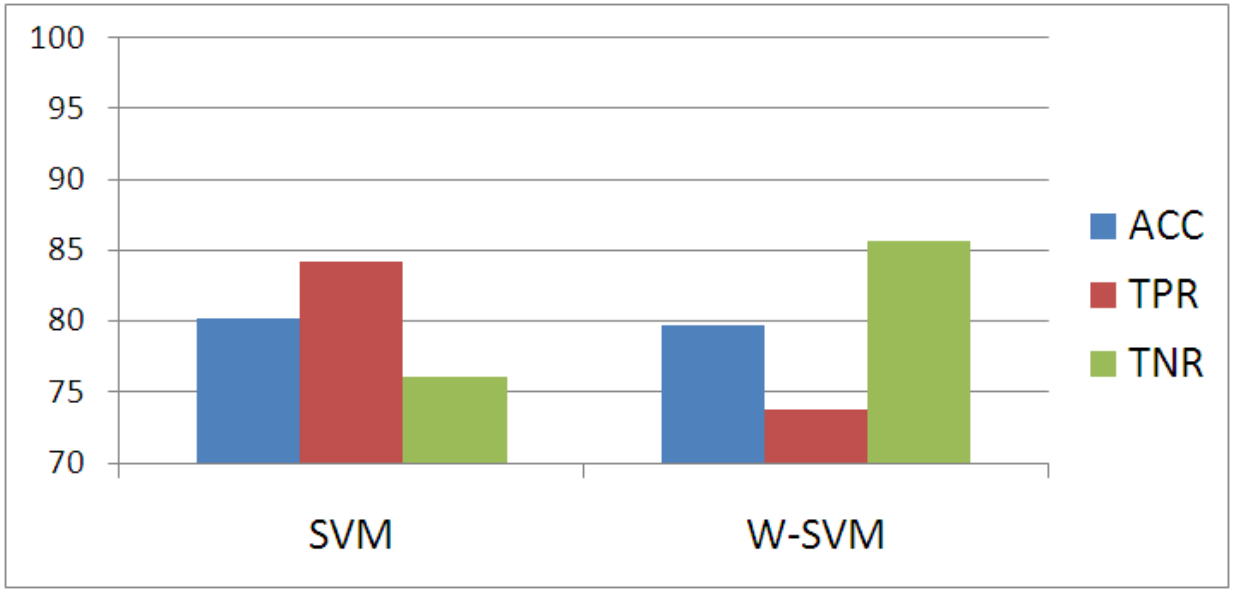
Results

LFW → Gallagher's



- Lower ACC than intra-LFW tests
- Similar ACC to non-weighted SVM
- TPR-TNR imbalance (inverted)

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Conclusions

- Standardized protocol for Gallagher's (public)
- Single- Database experiments:
  - 105x120 ROI performs better
  - Gabor jets and LBPs better than pixels
  - Linear SVM and LDA have similar performance
  - Balanced TPR and TNR in Gallagher's, not in LFW

	Pixels	Gabor	LBPs
Ours	79.16%	86.61%	86.34%
Others	[1] 69.96%	[2] 75.7%	[2] 77.4%

[1] A. Gallagher and T. Chen. Understanding Images of groups of People, CVPR09.
[2] C. Shan. Learning local features for age estimation on real-life faces, MPVA10.

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Conclusions

- Cross- Database experiments
  - Good generalization properties with Gallagher's
  - Good performance estimate with Gallagher's
  - LFW causes TPR-TNR imbalance

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Thank you for your attention!

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