



ACM MM'17 Workshop on Multimodal Understanding
of Social, Affective and Subjective Attributes
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Head Pose Recommendation for Taking Good Selfies

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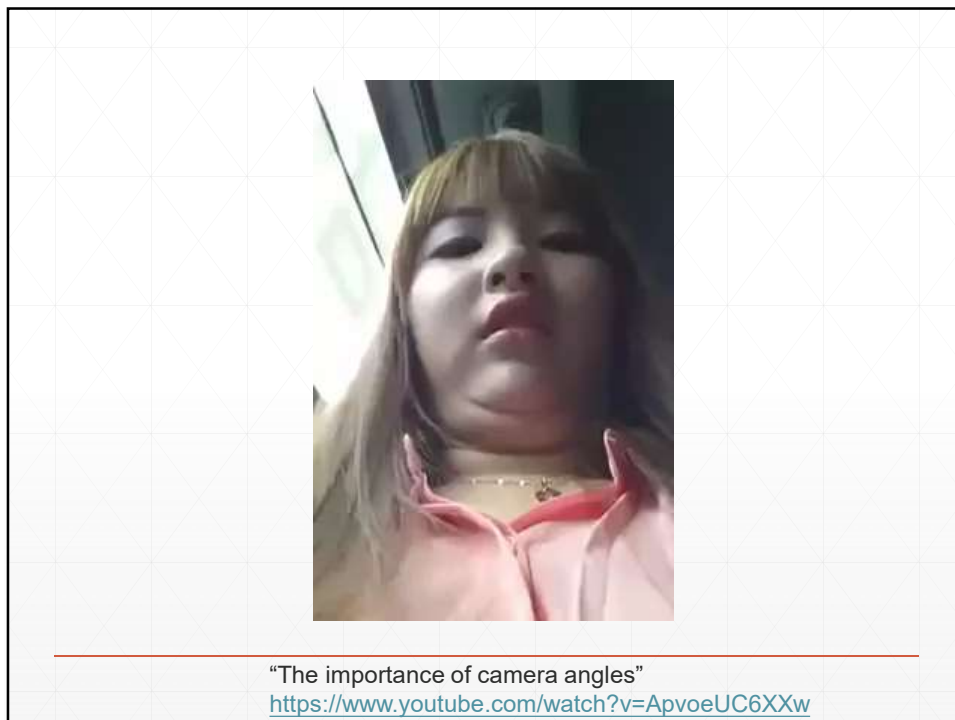
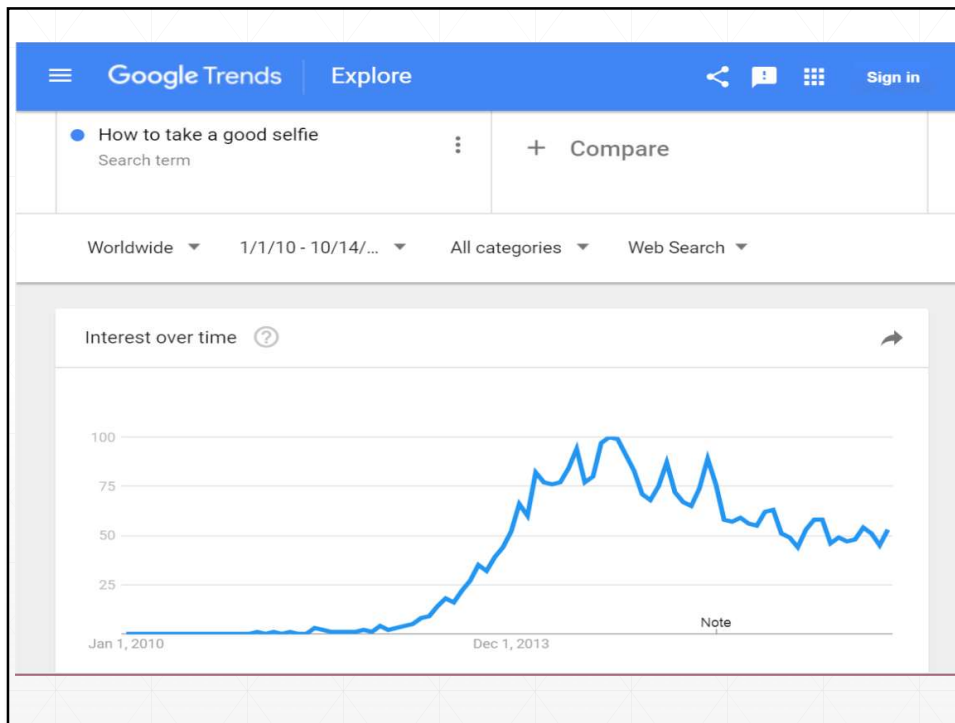
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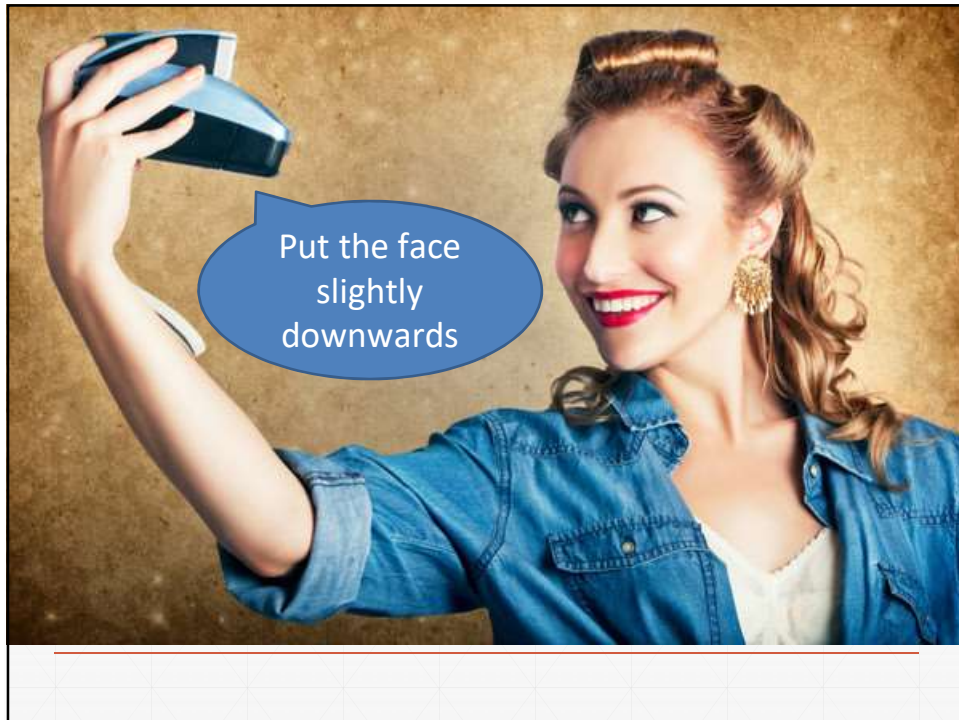


The "selfie" phenomenon



Image sources: <http://www.azfamily.com/>
<https://www.theverge.com/2017/5/10/15606498/how-to-take-the-perfect-selfie>





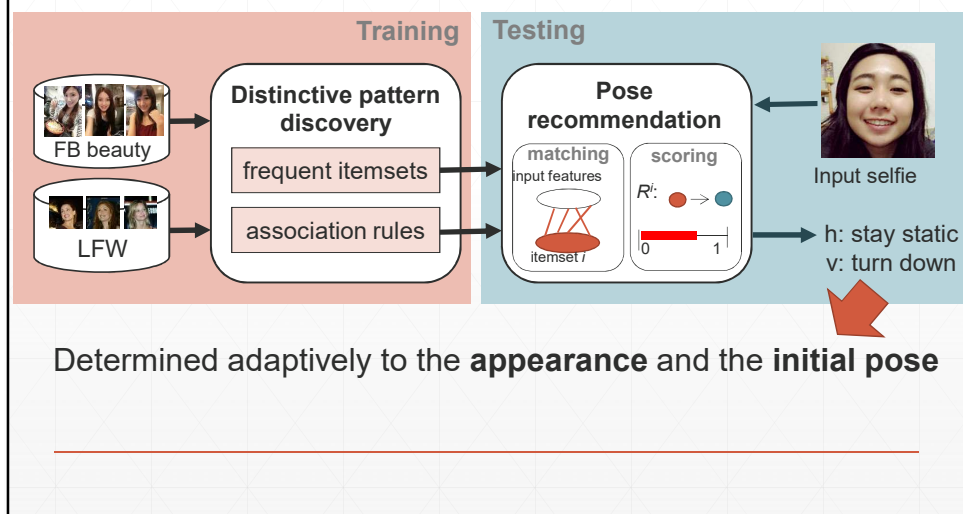
Outline

- Introduction
 - **Approach**
 - Datasets
 - Pattern formation and mining
 - Recommendation schemes
 - Experiments
 - Conclusion
-

A data mining approach

- Selfies on social media often lack ground truth labels.
- Only weakly labeled data (a set of “positive” training images) are used.
- Allows to process large training sets rapidly
- Discovered visual patterns are discriminative and easy to interpret.

Framework



Training datasets

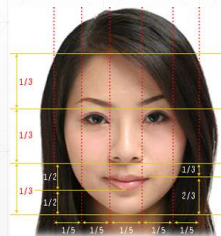
- Facebook beauty (6,785)
- Labeled Faces in the Wild (12,973)



Erik Learned-Miller et al., "Labeled Faces in the Wild: A Survey." *Advances in Face Detection and Facial Image Analysis*, pages 189-248, 2016.

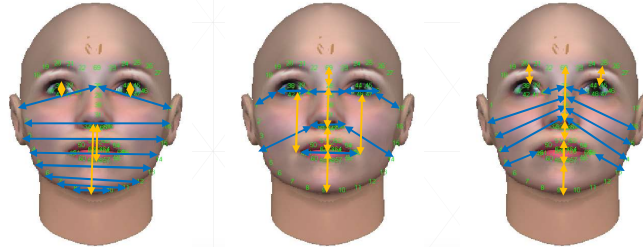
Pattern formation

- "Golden ratios" in selfies?
- Line patterns
 - Capturing the size of isolated facial features and their spatial relationship
 - The relationship between pose changes and the lines is known.



Pallett, Link and Lee, "New Golden Ratios for Facial Beauty," *Vision Research*, 50: 149–154, 2010.

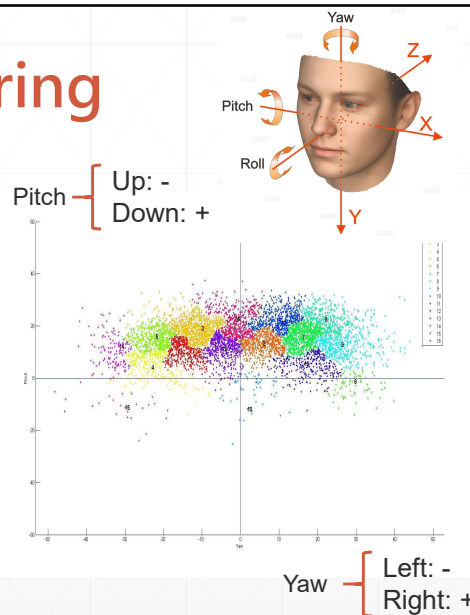
Pattern formation



- Transforming features to items
 - Obtaining the pattern distribution from LFW
 - Using a uniform scalar quantizer with 9 bins
- A face image has 45 items; each is indexed by one of the possible 405 ($45 \cdot 9$) items.

G. Tzimiropoulos and M. Pantic, "Optimization Problems for Fast AAM Fitting in-the-Wild," *IEEE International Conference on Computer Vision*, 2013.

Pose clustering

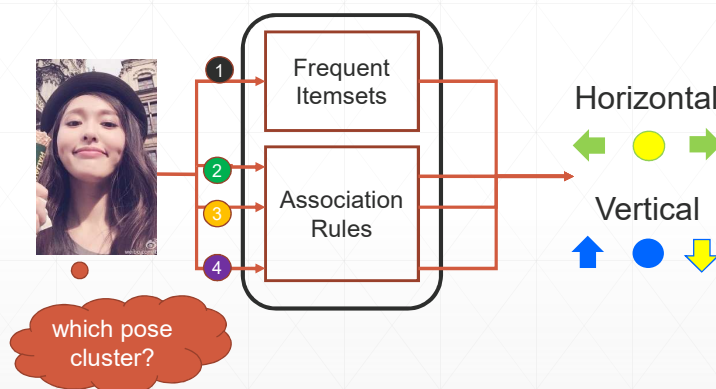


Pose-wise pattern mining

- Formulating a problem of association rule learning
 - Transaction ~ Selfie
 - Items ~ Quantized line features
- Using the Apriori algorithm to find frequent itemsets and association rules
- Filtering the association rules by keeping only those that infer selfies with high confidence:



$$\text{conf}(P \rightarrow \text{beauty}) > \text{conf}_{min}$$

Pose recommendation



Pose recommendation

$$P_L \Rightarrow P_R$$

- P_L and P_R are frequent itemsets.
 - Transactions containing P_L are highly likely to contain P_R as well.
 - Which P_L ?
 1. Itemset size 
 2. Degree of matching between the itemset and the image 
-

Pose recommendation

$$P_L \Rightarrow P_R$$

- P_L and P_R are frequent itemsets.
- Transactions containing P_L are highly likely to contain P_R as well.
- Which P_L ?

$$|P_L^i| \times e^{-M_i} \times R_{conf}^i$$

Itemset size

Degree of matching

Rule confidence

Pose recommendation

Itemset	Using the highest scored itemset	1
Rule-1	Using the highest scored association rule	2
Rule-2	Using high scored rules (above a threshold)	3
Rule-3	Using all rules	4

$P_L \Rightarrow P_R$ Each feature suggests a head movement that will lead to the feature being matched.

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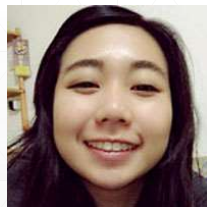
Experiment: Data

- A test set from Facebook containing 50 selfies of Asian women
- Ground true data collected from five professional photographers



Experiment: Data

- A test set from Facebook containing 50 selfies of Asian women
- Ground true data collected from five professional photographers



What instruction would you give to the selfie-taker to improve how she looks in the selfie?

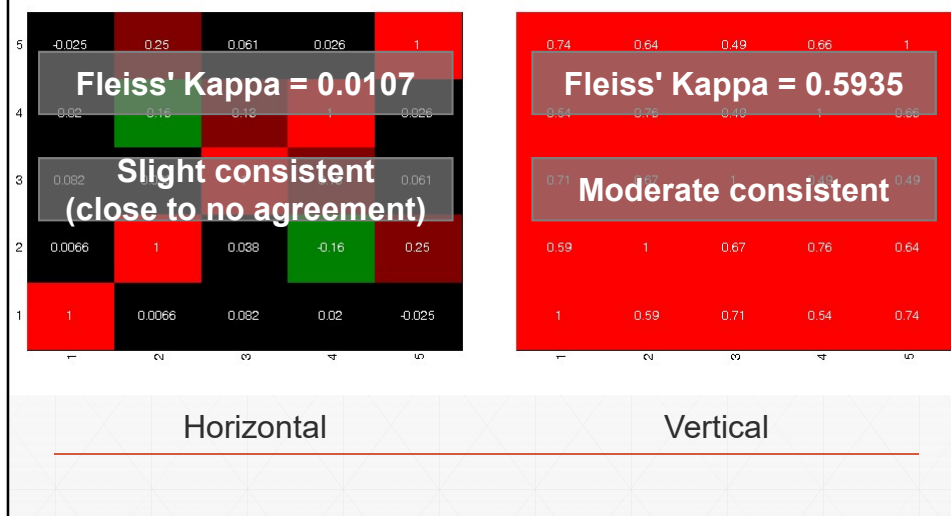
Turn head left, stay static, turn head right
Tilt head up, stay static, tilt head down

Experiment: Measurement

- Fleiss' kappa
- Pairwise Cohen's kappa

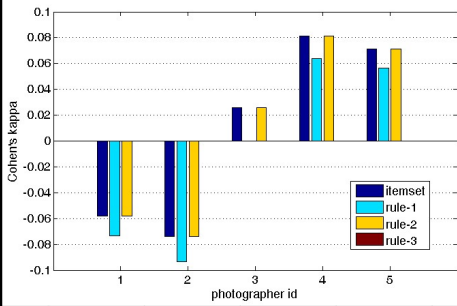
<i>k</i>	Interpretation
<0	No agreement
0.01 – 0.20	Slight
0.21 – 0.40	Fair
0.41 – 0.60	Moderate
0.61 – 0.80	Substantial
0.81 – 1.00	Almost perfect

Interrater reliability

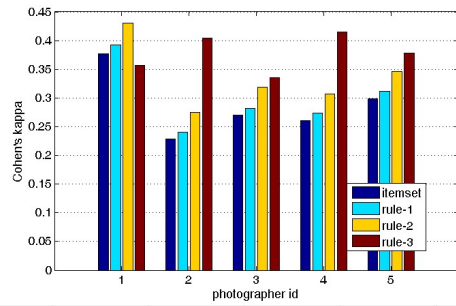


Evaluation results

4 > 3 > 2 > 1

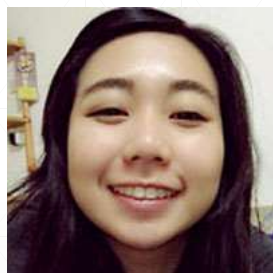


Horizontal

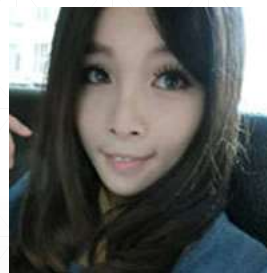


Vertical

Examples



(H): stay static
(V): turn down



(H): stay static
(V): stay static

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Conclusions

- Developed “Virtual Photographer”—a software program that helps users take well-pose selfies
 - Took a data mining approach that discovers frequent itemsets and association rules from a “positive” training set
 - Proposed four recommendation approaches that give head pose adjustments
 - Little consensus among users for adjusting horizontally the head pose
 - The recommendation performance for the vertical adjustment is moderately consistent with the professional photographers’ recommendations.
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More information:

<http://www.csie.ntnu.edu.tw/~myeh>
