

1 Problem Definition

- Imbalanced data distribution

1 : 4162 | X-domain

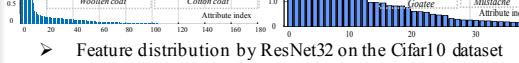


1 : 43 | CelebA

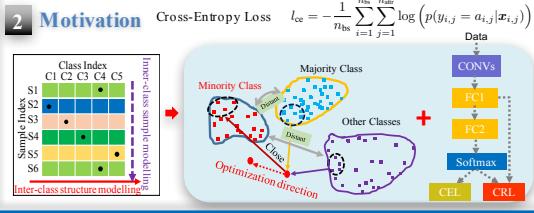


Attribute index

Feature distribution by ResNet32 on the Cifar10 dataset



2 Motivation



6 Experiments

- Comparison to the state-of-the-arts

CelebA

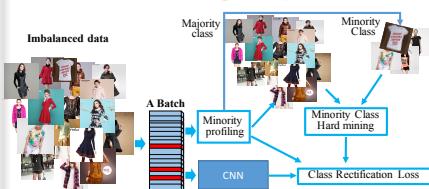
| Method | mAP(%) | X-domain | Method | mAP(%) |
|---------------|-----------|----------|---------------|--------------|
| DeepID2[2] | 81 | | MTCT[4] | 73.53 |
| LMLE[3] | 84 | | LMLE[3] | 75.77 |
| CRL(C) | 85 | | CRL(C) | 78.24 |
| CRL(I) | 86 | | CRL(I) | 79.66 |

Face Attributes recognition



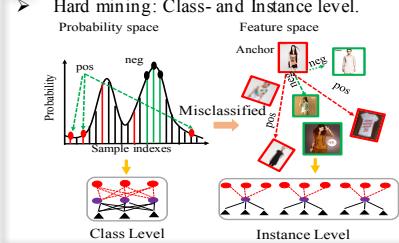
3 Overview of Proposed Approach

- Batch-wised minority profiling.

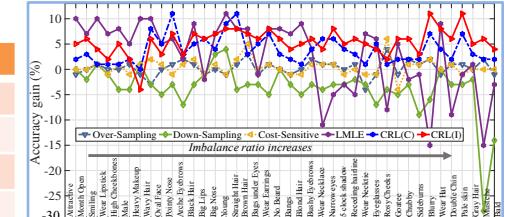


4 Minority Class Hard Mining

- Hard mining: Class- and Instance level.



Comparison of different imbalanced learning methods



Clothing Attributes recognition



5 Balancing by Class Rectification Loss (CRL)

$$l_{blr} = l_{crl} + l_{ce}$$

- Relative comparison based CRL
Inspired by Triplet Ranking loss

$$l_{crl} = \frac{\sum_T \max(0, m_j + \text{dist}(\mathbf{x}_{a,j}, \mathbf{x}_{p,j}) - \text{dist}(\mathbf{x}_{a,j}, \mathbf{x}_{n,j}))}{|T|}$$

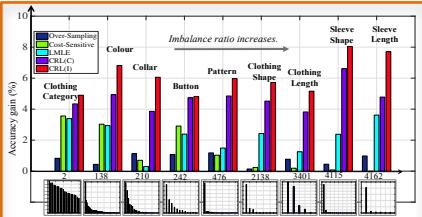
- Absolute comparison based CRL
Inspired by contrastive loss.

$$l_{crl} = 0.5 * \left(\frac{\sum_{P^+} \text{dist}(\mathbf{x}_{i,j}, \mathbf{x}_{p,j})^2}{|P^+|} + \sum_{P^-} \max(m_{apc} - \text{dist}(\mathbf{x}_{i,j}, \mathbf{x}_{n,j}), 0)^2 \right)$$

- Distribution comparison based CRL
Inspired by histogram loss [1]

$$l_{crl} = \sum_{t=1}^{\tau} (h_t^+ + \sum_{k=1}^t h_k^-) \quad h_t^+ = \frac{1}{|P^+|} \sum_{(i,j) \in P^+} \varsigma_{i,j,t}$$

$$\varsigma_{i,j,t} = \begin{cases} \text{dist}(\mathbf{x}_{i,j}, \mathbf{x}_{p,j}) - b_{t-1}, & \text{if } \text{dist}(\mathbf{x}_{i,j}, \mathbf{x}_{p,j}) \in [b_{t-1}, b_t] \\ \frac{b_{t+1} - \text{dist}(\mathbf{x}_{i,j}, \mathbf{x}_{p,j})}{\Delta}, & \text{if } \text{dist}(\mathbf{x}_{i,j}, \mathbf{x}_{p,j}) \in [b_t, b_{t+1}] \\ 0, & \text{otherwise} \end{cases}$$



References

- [1] Ustinova, et al. "Learning deep embeddings with histogram loss." NIPS 2016.
- [2] Y. Sun, Y. Chen, X. Wang, and X. Tang. Deep learning face representation by joint identification+verification. NIPS 2014.
- [3] C. Huang, et al. Learning deep representation for imbalanced classification. CVPR2016.
- [4] Q. Dong, et al. Multi-task curriculum transfer deep learning of clothing attributes. WACV2017.