Karlsruher Institut für Technologie

Computer Vision Praktikum

Landmark Recognition

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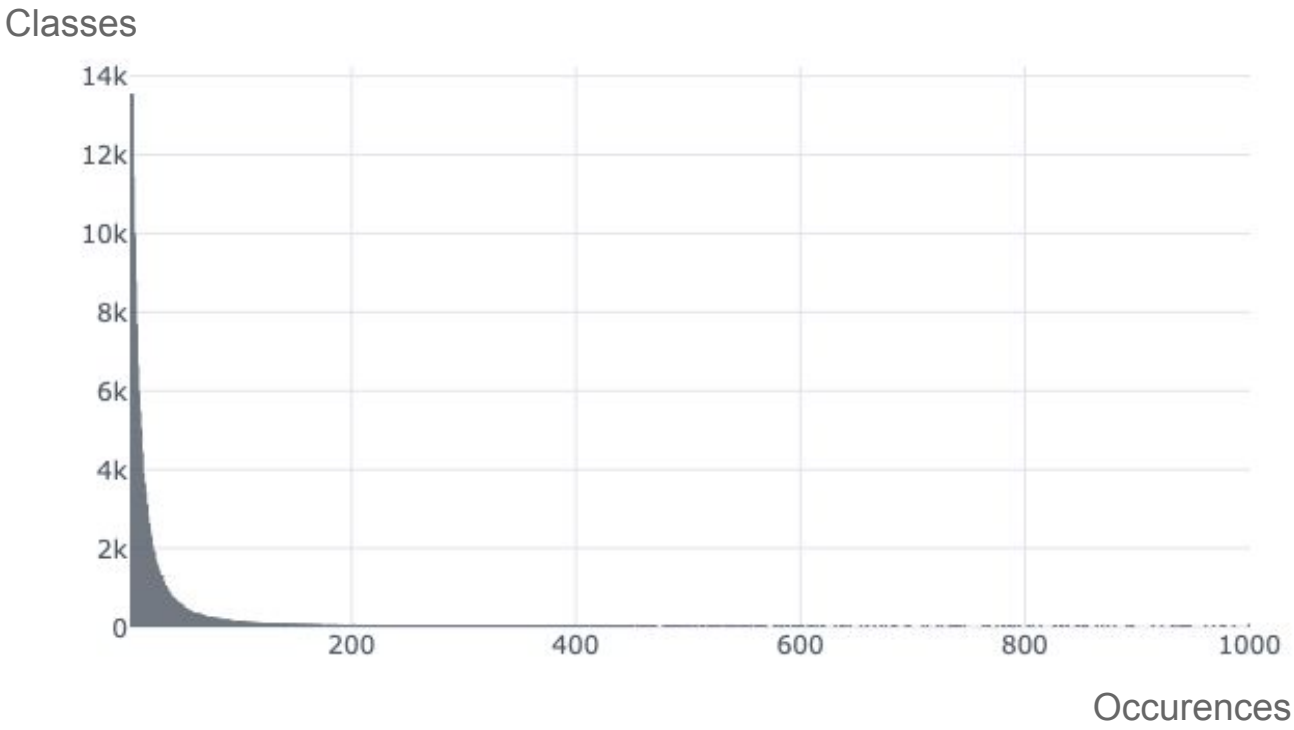
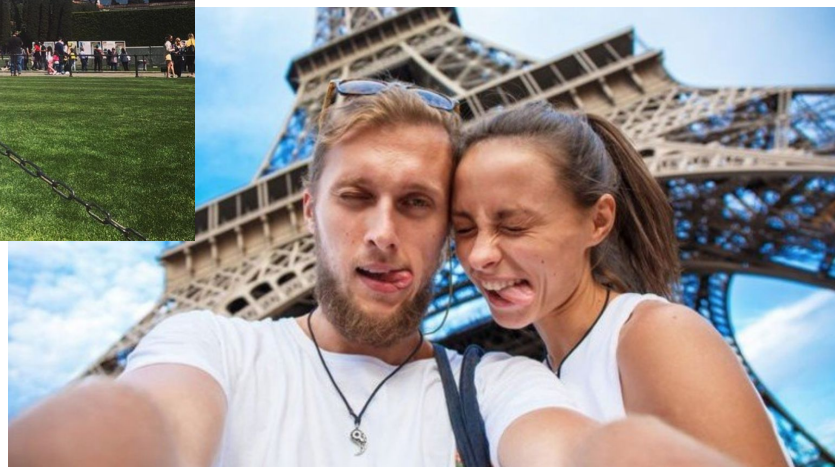
Motivation

Challenges


Classes
14k
12k
10k
8k
6k
4k
2k
0
200
400
600
800
1000
Occurences

Challenges



Challenges

Santa Maria Maggiore

Metric: Global Average Precision

$$GAP = \frac{1}{M} \sum_{i=1}^{N} P(i) rel(i)$$

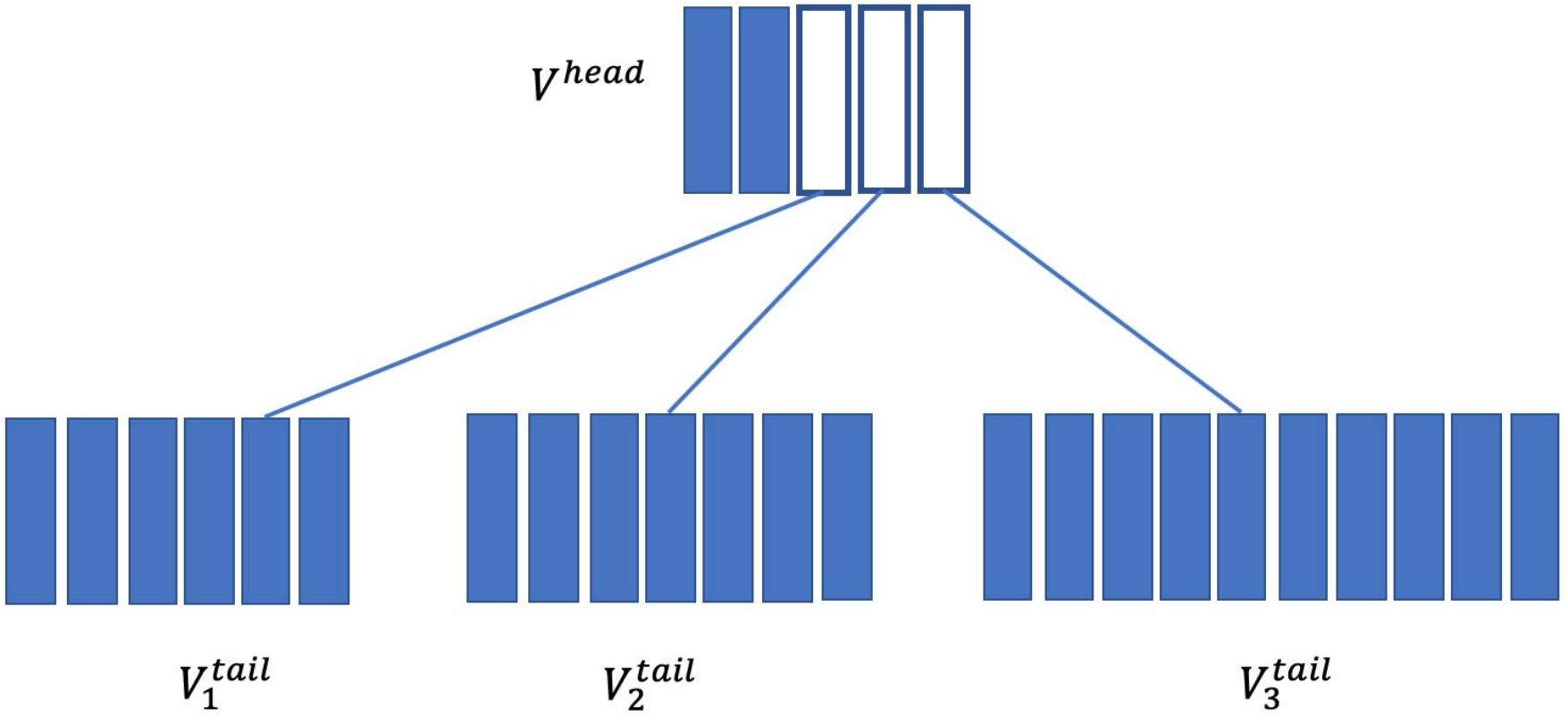
N	total number of predictions
M	total number of queries
P(i)	precision at rank *i*
rel(i)	relevance of prediction *i*

Baseline

- Random baseline
  - landmark: random label
  - confidence score: uniform distribution
  - GAP = 0%

- Training on 1000 classes
  - ResNet50 (pre-trained on Places365) + Cross entropy
  - GAP= 0%

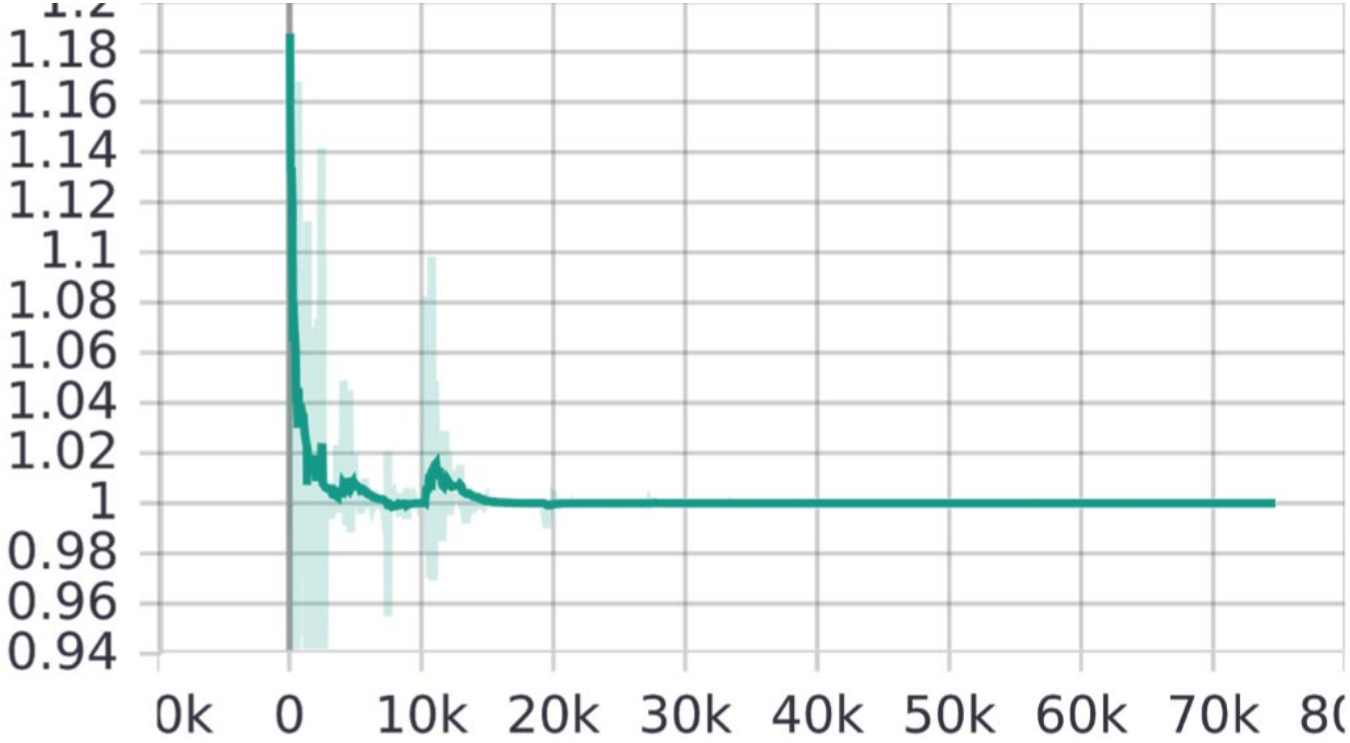
Experiment 1: Adaptive Softmax



GAP: 1.239%

Feature embedding

Experiment 2: Triplet loss



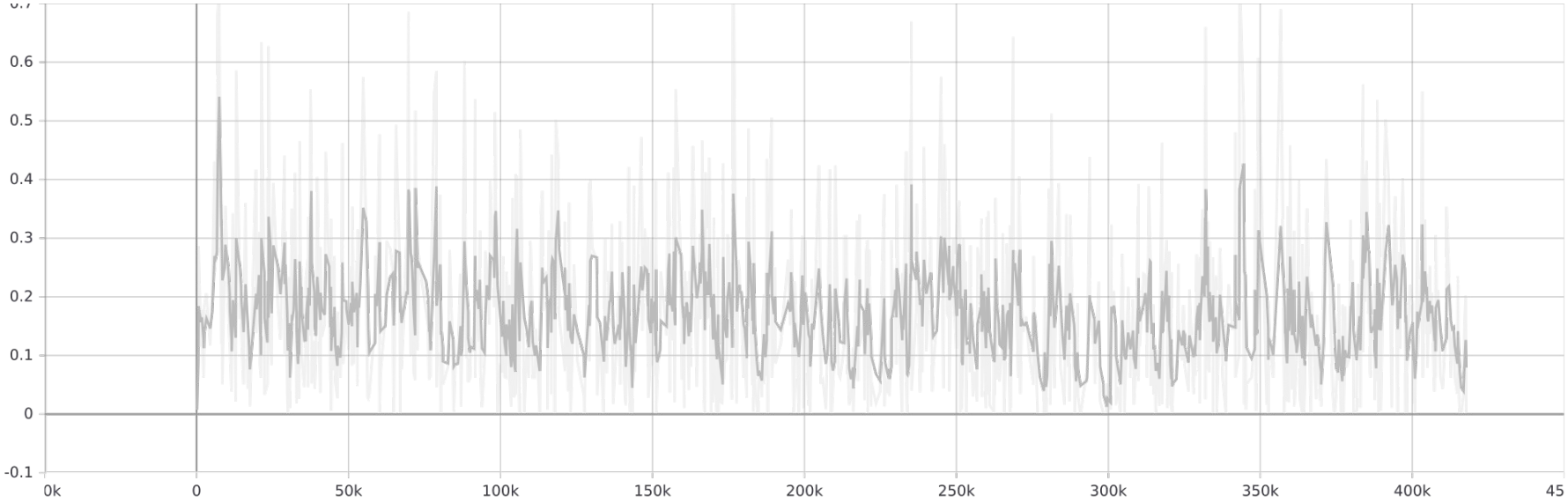
$$L(A, P, N) = \max(||f(A) - f(P)||^2 - ||f(A) - f(N)||^2 + \alpha, 0)$$

Related works - Solution of first-ranked team

- Data cleaning: matching pairs

- Training:
  - 6 CNN models
  - contrastive loss and triplet loss

Experiment 3: Triplet Loss on Matching Pairs



GAP = 1.248%

Experiment 4: Triplet Loss on Matching Pairs with Center Loss

Center Loss

GAP = 0.308

Results

Our Experiments	GAP (in Percentage)	Rank
Random	0	130 - 176
1000 Classes	0	130 - 176
Adaptive Softmax	1.239	100 🥉
Triplet Loss	0	130 - 176
Matching Pairs + Triplet Loss	1.248	100 🥉
Matching Pairs + Triplet Loss + Center Loss	0.398	113

Winners' Experiments	GAP (in Percentage)	Rank
JL	37.606	1
GLRunner	35.988	2
smlyaka	35.541	3

Outlook

- Modelling uncertainty (Prediction)
  - Bayesian modelling
  - Dropout during inference
- Re-ranking or Clustering (Post-Processing)
- Mixture of experts (Architecture)
  - Unsupervised learning for gating function
  - E.g. with FINCH clustering