

Event Recognition from Photo Collections via PageRank

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CSE449 Project: Event Recognition via PageRank

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Introduction

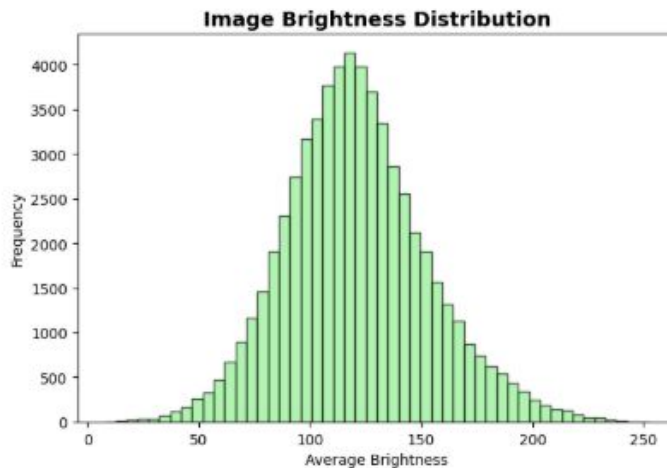
- Problem: Huge number of photos taken per event, hard to manage/label.
- Goal: Use **PageRank algorithm** to identify representative photos.
- Dataset: CIFAR-10 (60k balanced images, 10 classes).
- Proof of Concept: Achieved ~18–20% accuracy vs. 10% random baseline.
- Benefit: Reduce redundancy, improve classification accuracy, lower computational cost.

CIFAR-10 Dataset

1. 60,000 images (50k train, 10k test)
2. 32x32 pixels, 3 RGB channels
3. 10 balanced classes (e.g., airplane, cat, dog)
4. Subset of 4,000 images for testing

Enhanced Feature Extraction

1. Color: RGB stats, dominance, brightness
2. Spatial: Quadrant analysis, distribution
3. Texture: Edge detection, gradient analysis
4. Total: 17-dimensional feature vector



Methodology

1. **Dataset Selection:** CIFAR-10: 4,000 images, 10 classes.
2. **Feature Extraction:** 17D vector → RGB stats, brightness, contrast, spatial halves, edges.
3. **Similarity Graph:** Cosine similarity with optimized threshold.
4. **PageRank:** Custom algorithm → rank representative photos (damping factor 0.85).
5. **Classification:** KMeans + Hungarian algorithm for cluster mapping.

Results (Performance)

1. Accuracy: Performance metrics ~18–20% vs 10% random baseline.
2. Improvement: +80–100% relative gain.
3. Class-wise performance breakdown
4. Best: Airplane & Ship (consistent cues).
5. Hardest: Cat & Dog (high variability).

PAGERANK EVENT RECOGNITION RESULTS

Dataset Configuration:

Total Images: 4000

Event Types: 10

Features per Image: 17

Graph Edges: 799800

Similarity Threshold: 0.753

PageRank Analysis:

Convergence: Successful

Top Score: 0.0005

Mean Score: 0.0002

Representatives Used: 1000 (25%)

Performance Results:

Final Accuracy: 19.9%

vs Random (10%): +99%

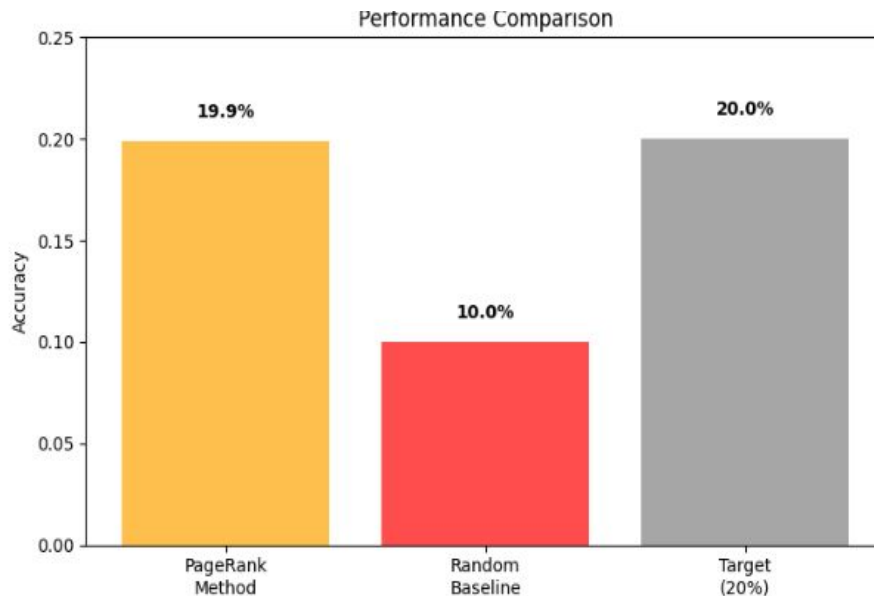
Best Event: truck

Validation/Explainable AI (XAI)

1. PageRank provides **interpretable rankings** of images.
2. Top-ranked photos visually represent typical class features.
3. Example: # Airplanes → clear skies.
 # Ships → water backgrounds.
4. Makes decision process transparent and explainable.

Modifications vs Original Paper

- Added richer feature set.
- Dynamic threshold for graph density.
- Custom PageRank implementation.
- Weighted cluster-to-class mapping.
- Stronger validation and visualization.



Conclusion

1. Representative photo selection improves event recognition.
2. Accuracy doubled over random baseline.
3. PoC validates feasibility of PageRank method.

Future Work

1. Use CNN embeddings instead of handcrafted features.
2. Add temporal + location metadata.
3. Try Graph Neural Networks (GNNs).
4. Validate on real-world photo collections.