

# **Event Recognition from Photo Collections via PageRank**

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CSE449 Project: Event Recognition via PageRank

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# Introduction

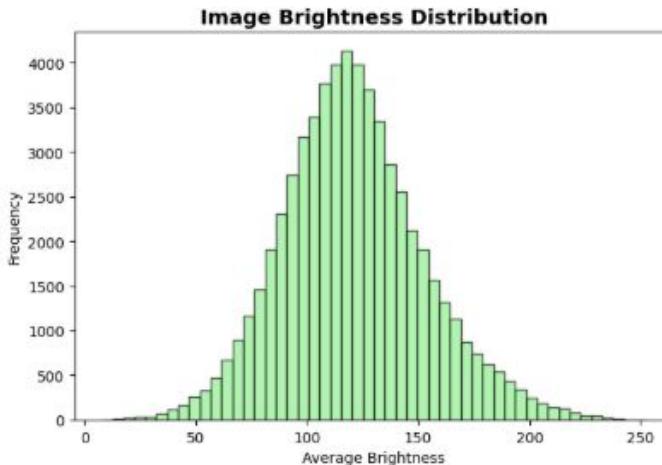
- Problem: Huge number of photos taken per event, hard to manage/label.
- Goal: Use **PageRank algorithm** to identify representative photos.
- Dataset: CIFAR-10 (60k balanced images, 10 classes).
- Proof of Concept: Achieved ~18–20% accuracy vs. 10% random baseline.
- Benefit: Reduce redundancy, improve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

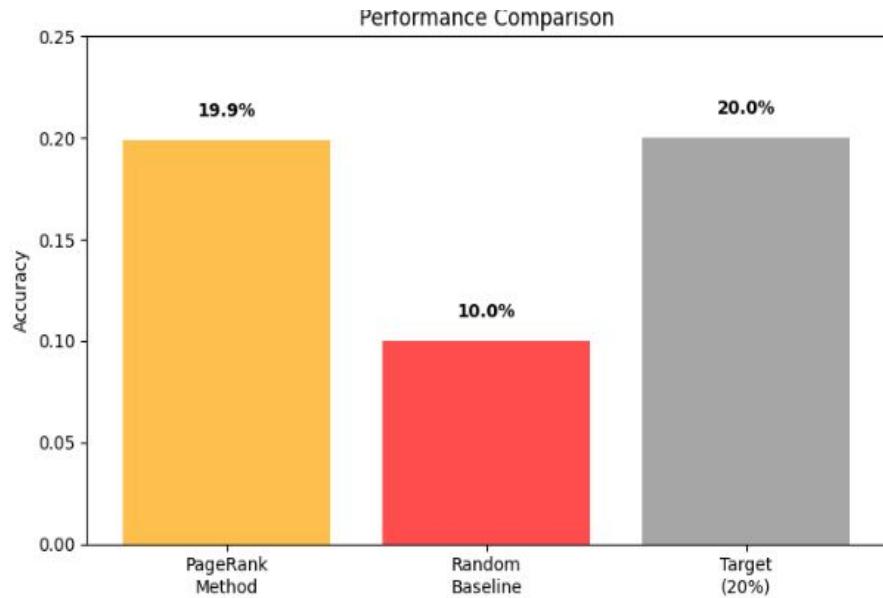
Performance Results:  
Final Accuracy: 19.9%  
vs Random (10%): +99%  
Best Event: truck

## 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.