Mapping Visual Themes among Authentic and Coordinated Memes

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Background & research question

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    - IRA employees are assessed for meme-making abilities — DiResta, Grossman, and Siegel 2021
- Observationally, what distinguishes state-linked memes from authentic memes?

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4. Label the clusters based on representative images and compare the difference in proportions between coordinated and authentic memes

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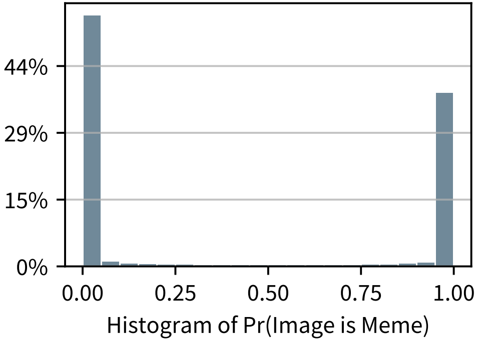
- 15K non-meme image-with-text data as negative samples (step 1)
  - COCO-Text: large scale dataset for text recognition in natural scenes (not superimposed)
  - Don't want models simply picking up textual features in images and classifying images into with vs. without text

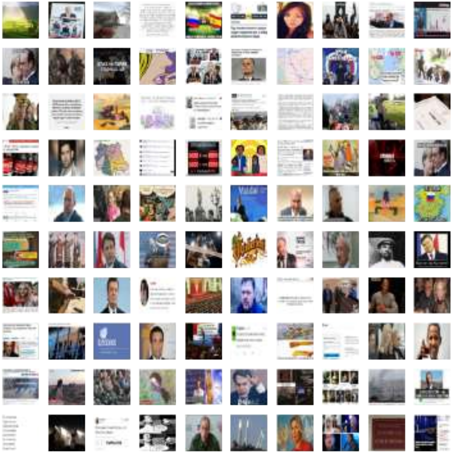
Example from COCO-Text Dataset

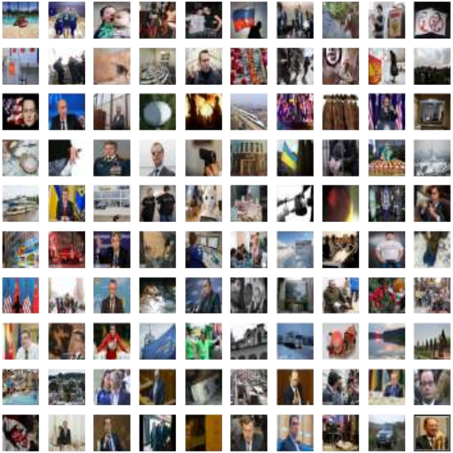
Classify IRA images into memes

- Data: memes from Reddit vs. non-meme images-with-text (COCO-text)
- Model: ResNet-50
- Performance: Accuracy > 0.97 on test set
- Apply the trained model on IRA images



Predicted IRA memes vs. non-memes





Identify themes in memes

- **Bag-of-Visual-Words**: useful for local features — Sivic and Zisserman 2003; Torres 2018
  - Identifies the keypoints using algorithms like SIFT
  - Builds patches around the neighbor of keypoints
  - Cluster the patches and count the occurrence of clusters

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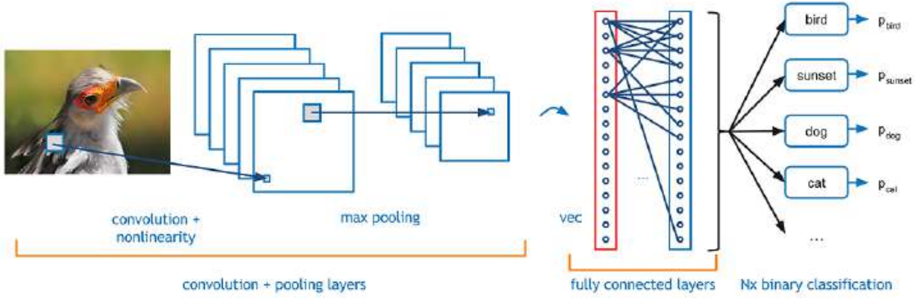
- Modern approaches use **transfer learning**
  - Pretrain on some large-scale data and apply it on another data
  - But many vision tasks are NOT useful for social scientists…

Many vision tasks are NOT useful



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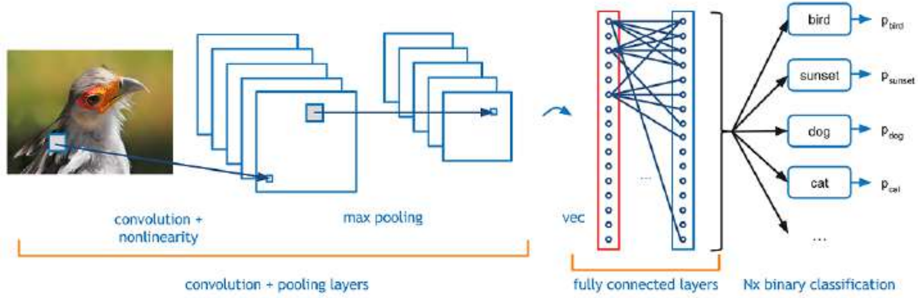

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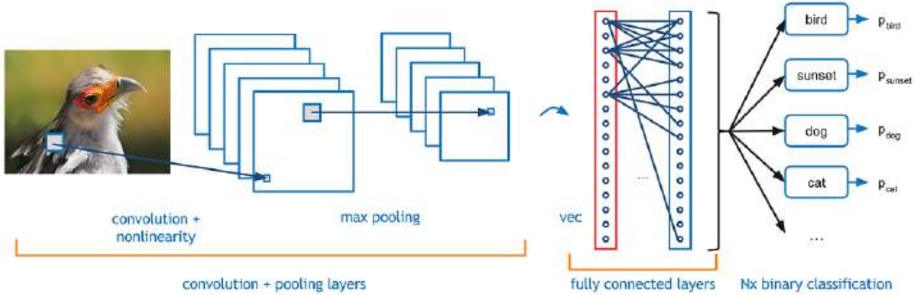
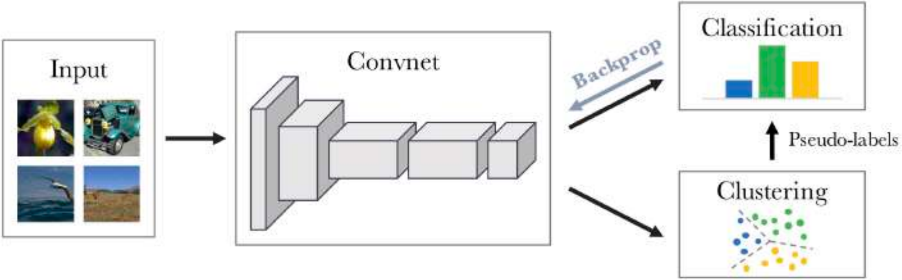


- Most pretrained classification labels are not of interest (dog breeds!)
- Most models are optimized for linear classification
- We often want to know about the relationship between images

DeepCluster (Facebook AI Reserach) Caron et al. 2019



Caron et al. 2019

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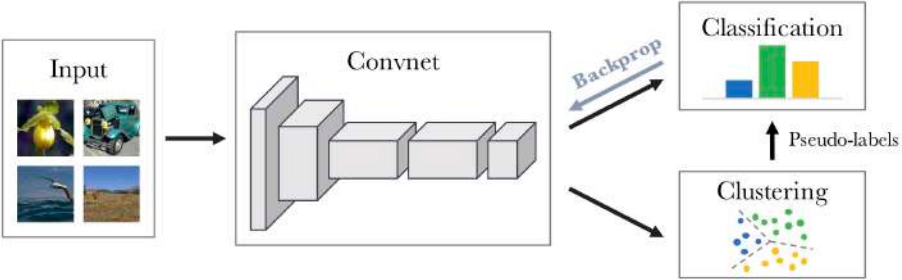

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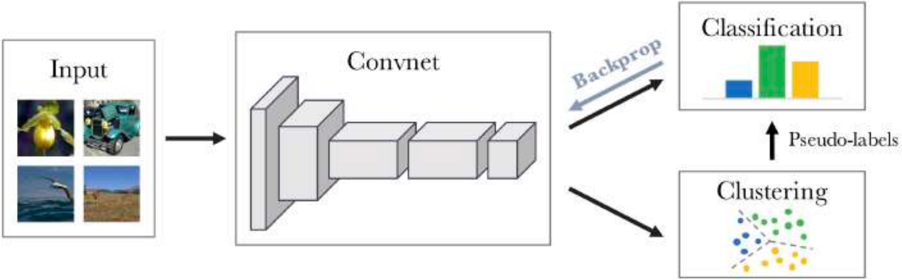

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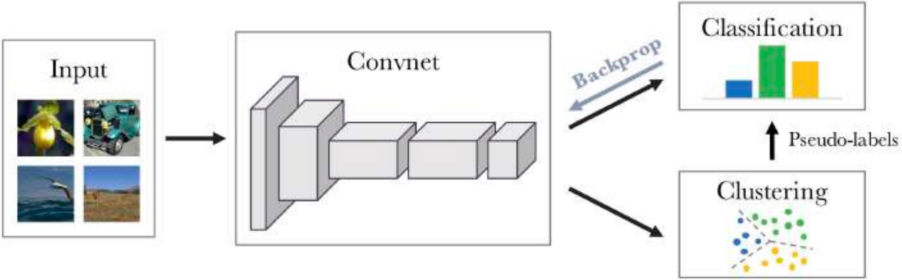

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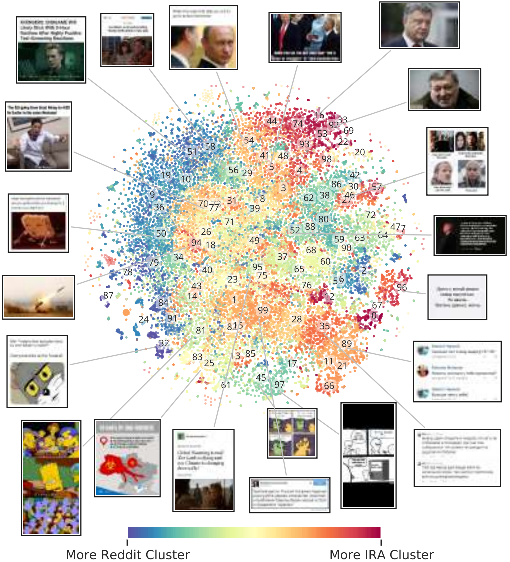
- Cluster assignments as pseudo-labels to train the CNN iteratively
- Map each meme into 4096-dimensional visual embedding space
- Open source, provide weights pre-trained on ImageNet as initialization
- Cluster on the embedding space (set $K = 100$) and label the clusters

t-SNE projection of the visual embedding



16: Male politician face

16

93: Gendered female image

93

94: Missles/bomb/war zone

94




















14: Russian symbols

14


















31: Military/police

31













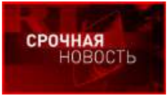


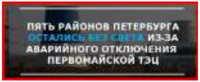


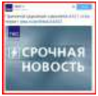



27: Slogans

27

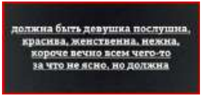






52: Quotes/face

52



48: Politician speaking

48




















45: 4 panel comics

45




















91: SpongeBob/Rick and Morty

91

51: Movie scene memes

51














87: Black Hackerman meme

87













32: Unsettled Tom meme

32









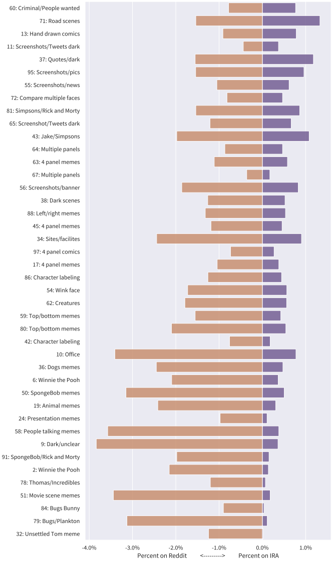


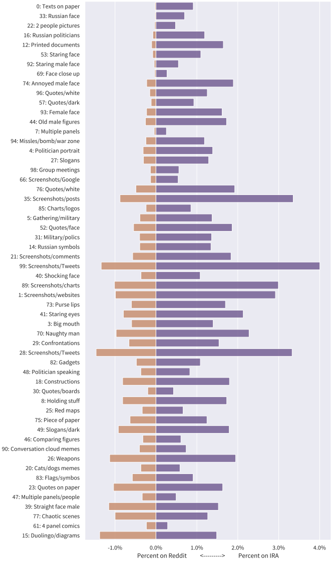






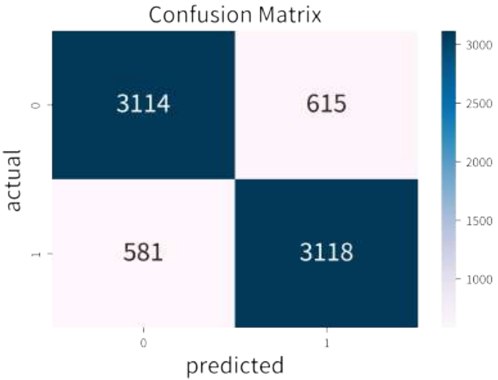
Theme distribution





Can machine discern coordinated memes?

- Logistic regression using only the 4096-d embeddings, 70/30 train/test split
- Training accuracy 0.90, AUC 0.91
- Testing accuracy 0.84, precision 0.84, recall 0.84, F_1-score 0.84



Limitations

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  - Russian IRA are outward-facing, targeted at US election
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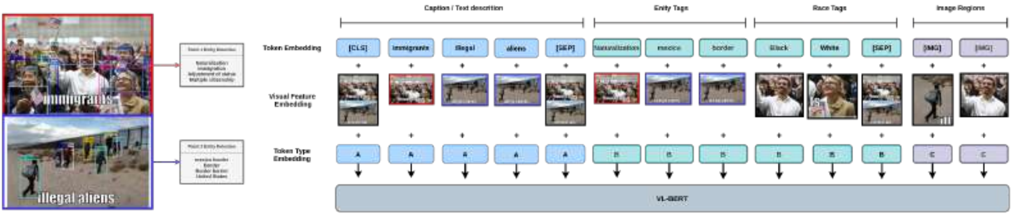
- Not account for text, languages, panel structures, and tweet-level metadata

Next steps

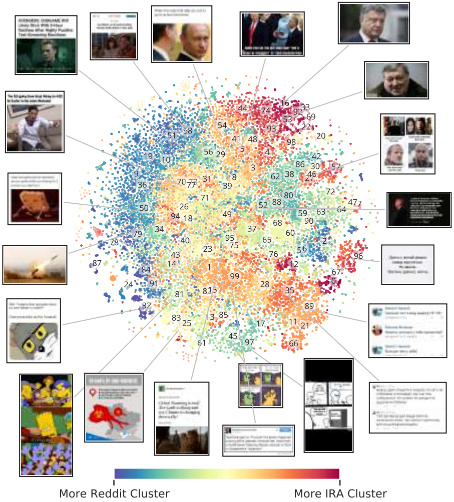
- Use multimodal transformer models (ex. VisualBERT) to extract feature embeddings that incorprate textual and text-scene information



Zhu 2020

- Preprocess memes to strip off "structures" unrelated to topic of memes
- More flexible clustering models to incorporate tweet-level covariates

Thank you!



Feedbacks, thoughts, comments welcome!!

`@kengchichang`

`https://arxiv.org/abs/2206.02306`

- Cluster on meaningful low-dim visual embeddings
- Authentic/coordinated memes share many themes
- Coordinated IRA memes military, gender, quotes
- Authentic Reddit memes comics, movie characters
- Logistic regression on visual embedding discern IRA memes with accuracy of 0.84

References I

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