Few-Shot learning using Yoga-82

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Introduction

Few-Shot learning using Yoga-82

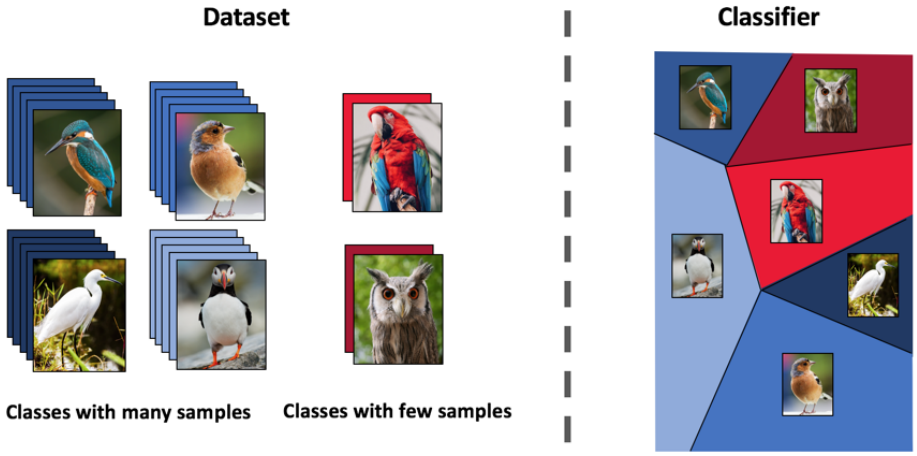

Figure: This Image is taken from [1]

Few-shot learning trains models with a small number of examples per class or task. It's vital in **low-resource environments** due to data scarcity.

Motivation

Few-Shot learning using Yoga-82

- FSL in robotics addresses rapid skill acquisition with minimal data.[2]
- FSL in audio tackles data scarcity for diverse speech tasks.[2]
- FSL in NLP enhances tasks with limited data samples.[2]

Literature Survey

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Few Shot Learning can be approached broadly by:

- Generative model based FSL approaches:
  - Transformation
  - Parameters
  - Superclass
- Discriminative model based FSL approaches:
  - Data Augmentation
  - Metric Learning
  - Meta Learning

This is taken from [2]

Literature Survey

Few-Shot learning using Yoga-82

- Unsupervised Few-Shot Learning
- Semi-Supervised Few-Shot Learning
- Cross-domain Few-Shot Learning
- Generalized Few-Shot Learning
- Multimodal Few-Shot Learning
  - **Multimodal Matching**
  - **Multimodal Fusion**

This is taken from [2]

Last Semester work

Few-Shot learning using Yoga-82

- **Previous Work:**
  - Literature Survey on yoga-82 dataset.
  - Approach to the problem.
  - Planning and gathering of resources.
  - Exploring the necessary libraries.
- **The Implementation:**
  - Fine-tuning and refining the yoga-82 dataset.
  - Implementation of the Prototypical Network along with low rank embedding.
  - Creating the Top-1 Accuracy table of previous models.
  - Creating the table for the different values of N and C using the created model.

The Yoga-82 Dataset

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- **Dataset Size:** Contains 28,370 images.
- **Classes:** Includes 82 different yoga poses.
- **Diversity:** Images are sourced from the internet, ensuring a wide variety of settings, angles, and lighting conditions.
- **Annotations:** Each image is labeled with the corresponding yoga pose.
- **Challenges:** Variations in clothing, backgrounds, camera angles, and practitioner expertise levels make it challenging and realistic for training robust models.

Implementation of the Prototypical Network

Few-shot learning using Yoga-82

Input: Training set $\mathcal{D} = \{(\mathbf{x}_1, y_1), \ldots, (\mathbf{x}_N, y_N)\}$, where each $y_i \in \{1, \ldots, K\}$. $\mathcal{D}_k$ denotes the subset of $\mathcal{D}$ containing all elements $(\mathbf{x}_i, y_i)$ such that $y_i = k$.

Output: The loss J for a randomly generated training episode.

$V \leftarrow \textsc{RandomSample}(\{1, \ldots, K\}, N_C)$ ▷ Select class indices for episode

for k in $\{1, \ldots, N_C\}$ **do**

$S_k \leftarrow \textsc{RandomSample}(\mathcal{D}_{V_k}, N_S)$ ▷ Select support examples

$Q_k \leftarrow \textsc{RandomSample}(\mathcal{D}_{V_k} \setminus S_k, N_Q)$ ▷ Select query examples

$$\mathbf{c}_k \leftarrow \frac{1}{N_C} \sum_{(\mathbf{x}_i, y_i) \in S_k} f_{\boldsymbol{\phi}}(\mathbf{x}_i)$$ ▷ Compute prototype from support examples

end for

$J \leftarrow 0$ ▷ Initialize loss

for k in $\{1, \ldots, N_C\}$ **do**

for $(\mathbf{x}, y)$ in Q_k **do**

$$J \leftarrow J + \frac{1}{N_C N_Q} \left[d(f_{\boldsymbol{\phi}}(\mathbf{x}), \mathbf{c}_k)) + \log \sum_{k'} \exp(-d(f_{\boldsymbol{\phi}}(\mathbf{x}), \mathbf{c}_{k'})) \right]$$ ▷ Update loss

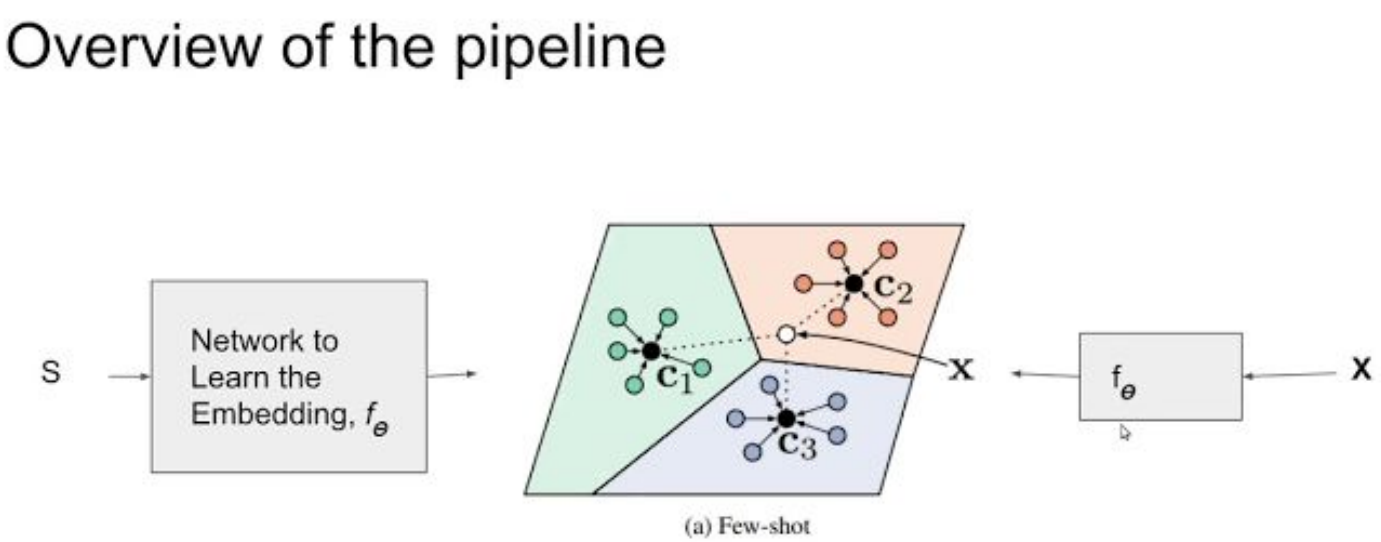
end for

end for

Figure: This Image is taken from [1]

Implementation of the Prototypical Network

Few-shot learning using Yoga-82



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The Results

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C values	**N values**				
	N = 2	**N = 5**	**N = 10**	**N = 15**	**N = 20**
C = 1	0.52	0.182	0.123	0.088	0.065
C = 2	0.5175	0.236	0.126	0.088	0.071
C = 5	0.234	0.244	0.142	0.098	0.081
C = 10	0.135	0.259	0.16	0.104	0.085

Table: Table comparing results for different values of C and N.

Top-1 Accuracy of Other Models

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No.	Paper Title (Abbreviated)	Accuracy
1	Efficient CNN for Yoga Pose Recognition [3]	93.28%
2	Fine-Grained Sports and Yoga Posture Analysis [4]	79.35%
3	Representation Learning by Detecting Incorrect Embeddings [5]	65.1% (MoCoV), 77% (DINO)
4	CAM-Based Multi-Stage Transfer Learning [6]	90.00%
5	Robust Classification of Similar Yoga Poses [7]	87.33%
6	Yoga Posture Analysis with Deep Learning [8]	92.50%
7	CNN-Based Yoga Pose Recognition [9]	87.89%
8	YogMaster: Yoga Posture Detection with AR [10]	99.47%

Future work and Scope

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- **Future Work Directions:**
  - Improved Pose Recognition Models
  - Transfer Learning
  - Multimodal Learning
  - Cross-Cultural Yoga Variants
- **Applications:**
  - Fitness Tracking and Virtual Trainers
  - Healthcare and Rehabilitation
  - Gamified Yoga Experiences
  - Educational Tools
  - Smart Home Integration
  - Research in Movement Science
  - Cultural Preservation and Analysis

Thank You

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