

SHADOW VARIATIONS

A MULTI-DIMENSIONAL AI EXPLORATION OF HAND SHADOW DATASETS

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01 THE DATASET & METHODOLOGY

Introduction & Dataset Construction

This dataset is a collection of hand shadow images featuring three distinct categories: Bird, Dog, and Snake, with all materials sourced from original, self-captured photography. To ensure a standardized and scalable workflow, a custom Python automation script was implemented to organize the repository into a professional Dataset_Final directory architecture.

Capture & Diversity

Gestures (Bird, Dog, Snake) recorded under controlled single-source lighting, encompassing diverse hand sizes and projection angles.

Preprocessing

Images were unified, grayscaled, and resized to 128×128 pixels as tensors for optimal feature extraction.



Fig 1: Samples from our custom grayscale hand shadow dataset (Bird, Dog, Snake).

Approach 2: Critical Social Experiment

While humans embrace ambiguity through context-driven imagination, the CNN is mathematically forced by its Softmax architecture to assign 100% probability across predefined classes. This inherent lack of doubt critiques the reductive nature of AI, which violently simplifies complex, blurred realities into forced certainties.

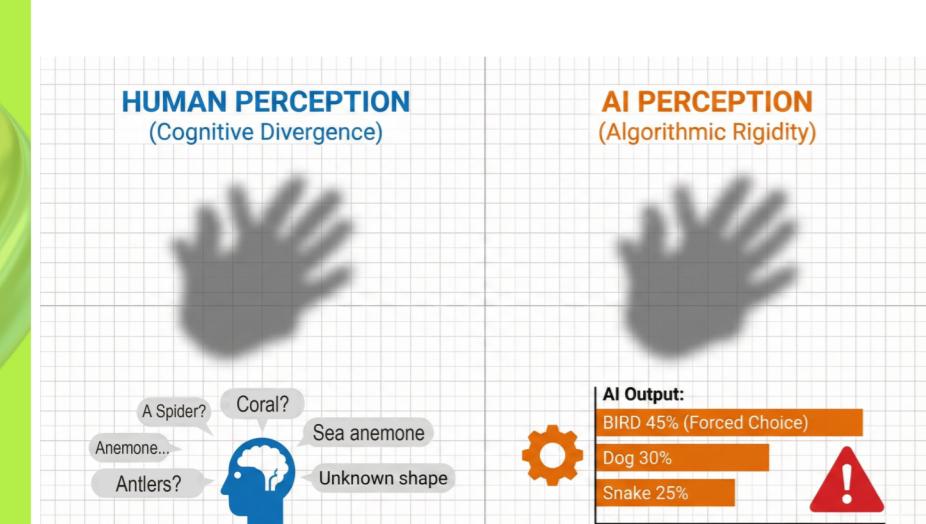


Fig 4: Divergent human imagination vs. Forced algorithmic classification (Softmax limitation).

Point 1:

Algorithms, bound by Softmax architecture, force all signals into categories, systematically excluding nameless realities that fall outside predefined boundaries.

Point 2:

Digital reductionism simplifies divergent human imagination into cold probability distributions, dissolving cognitive complexity and the aesthetics of ambiguity.

Approach 3: Healthcare Speculation

Inspired by a reverse thinking about the "temporal artifacts" in the hand shadow dataset of this project, we critically transform the dynamically blurred ghost images into key physiological diagnostic signals containing neuromuscular feedback.

Concept

The proposal utilizes Low Frame Rate (LFR) cameras to encode micro-tremors into blur features as subjects maintain specific shadow forms. By calculating the Laplacian Variance of the shadow contour boundaries, an objective Stability Index is derived to quantify fine motor skills without specialized hardware.



Fig 6: Visualization of micro-tremors hindering daily activities



Fig 5: Proposed telehealth interface utilizing hand shadow edge-blur to derive a quantitative Stability Index.

Application

This approach offers a non-invasive, privacy-preserving telehealth solution. By processing only abstract silhouettes, it avoids sensitive biometric data such as facial features, enabling early screening for motor disorders like Parkinson's disease to be integrated into domestic environments in a relaxed, gamified manner.

02 CREATIVE APPLICATIONS

Approach 1: Creative Interactive System

This project speculates on an interactive educational theater that utilizes real-time AI to transform traditional hand shadows into a multi-sensory experience, guiding children to explore nature through embodied play by linking shadow movements into complete sonic narratives.

Pipeline

Dataset Input → Real-time CNN Recognition
→ Multimedia Engine Triggering →
Generative Storytelling Logic

Logic

When the model's Softmax confidence exceeds a 0.8 threshold, the silhouette "comes to life" with audio-visual feedback, providing real-time educational reinforcement.



Fig 3: Prototype of the interactive theater triggering digital animations via live inference.

03 SHARED OBSERVATIONS

Summarize

"Shadow Variations" demonstrates that a single dataset can transcend the boundaries of art, sociology, and medicine. Through a deep exploration of "shadows" as an abstract medium, the project not only showcases the technical potential of CNNs in feature extraction but also reflects the speculative value of computational arts in addressing real-world issues, such as privacy-preserving healthcare monitoring.

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