

BIOLOGICAL PLAUSIBLE BABYAI

Where curiosity meets sensation

ABOUT ME



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“The essence of this work is not only in the code, but in the journey itself. Within every obstacle, a hidden truth appeared - that learning is born from curiosity, shaped by persistence, and carried by imagination. BabyAI is less a machine, and more a glimpse into how intelligence awakens.”



BIOLOGICAL BABYAI

- ✓ Learns Like an Infant
- ✓ Curiosity Driven
- ✓ Multisensory (Audio + Vision)
- ✓ Biologically Plausible

TABLE OF CONTENTS

BABYAI

1	OUR PROBLEM LITERATURE GAP	2	AIMS & MOTIVATION OBJECTIVES BABYAI
3	BIOLOGICAL CONCEPTS CONCEPTS BABYAI	4	LIGHTS TO SPIKES BABYAI VISION
5	SOUND TO SPIKE BABYAI AUDITION	6	NEURAL FIRING BABYAI ARCHITECTURE
7	APPLICATIONS USAGE OF BABYAI	8	ACHEIVEMENTS BABYAI
9	FUTURE WORK PLANS AHEAD	10	CONCLUSION BABYAI

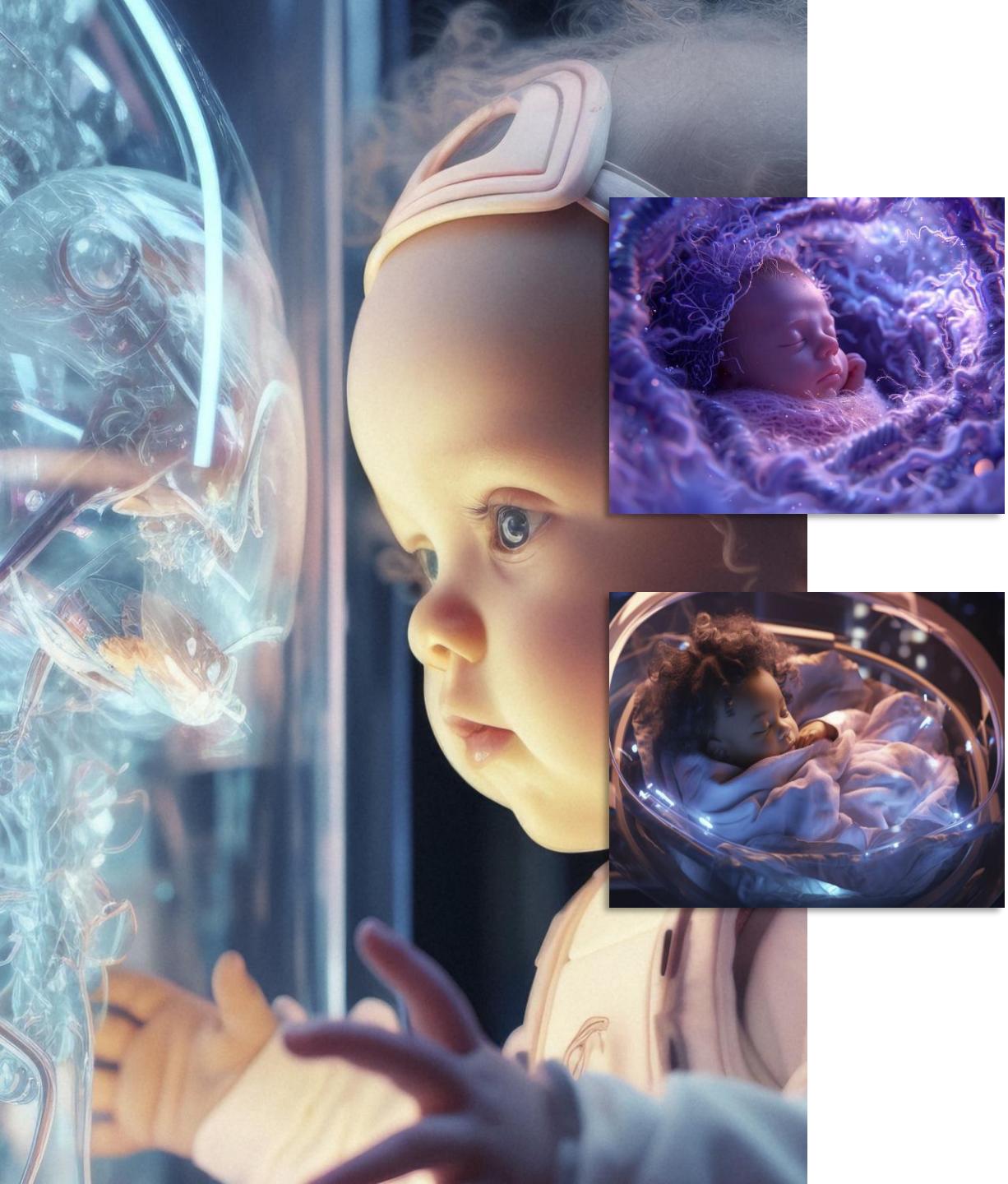
PROBLEM STATEMENT

- i. Data-hungry, brittle AI
- ii. No curiosity / lifelong learning
- iii. Catastrophic forgetting
- iv. Weak biological plausibility
- v. Open-world uncertainty



LITERATURE GAP

- i. Infants: curiosity, few labels, multisensory
- ii. AI: supervised, static, forgetful
- iii. Gap: No biologically grounded, curiosity-led multisensory learner



AIMS & MOTIVATION

BABYAI

- ✓ Aim: Build infant-like, curiosity-driven, multisensory AI
- ✓ Objectives: Vision+Audition; Hebbian/STDP+Dopamine; Prototype memory; Open-set
- ✓ Motivation: From data-driven to experience-driven learning

BIOLOGICAL CONCEPTS

BABYAI

- ✓ Hebbian Learning – “Fire together, wire together”
- ✓ STDP – Spike-timing dependent plasticity (timing matters)
- ✓ Dopamine Modulation – Curiosity & reward-driven learning (3-factor rule)
- ✓ Global Workspace Theory – Attention & integration of senses





LIGHTS TO SPIKES

BABYAI VISION

- ✓ Retina → LGN → V1 → IT
- ✓ DoG + Gabor filters
- ✓ Prototypes & recognition
- ✓ Dopamine modulation

JOURNEY: FROM LIGHTS TO SPIKES

VISION BABYAI

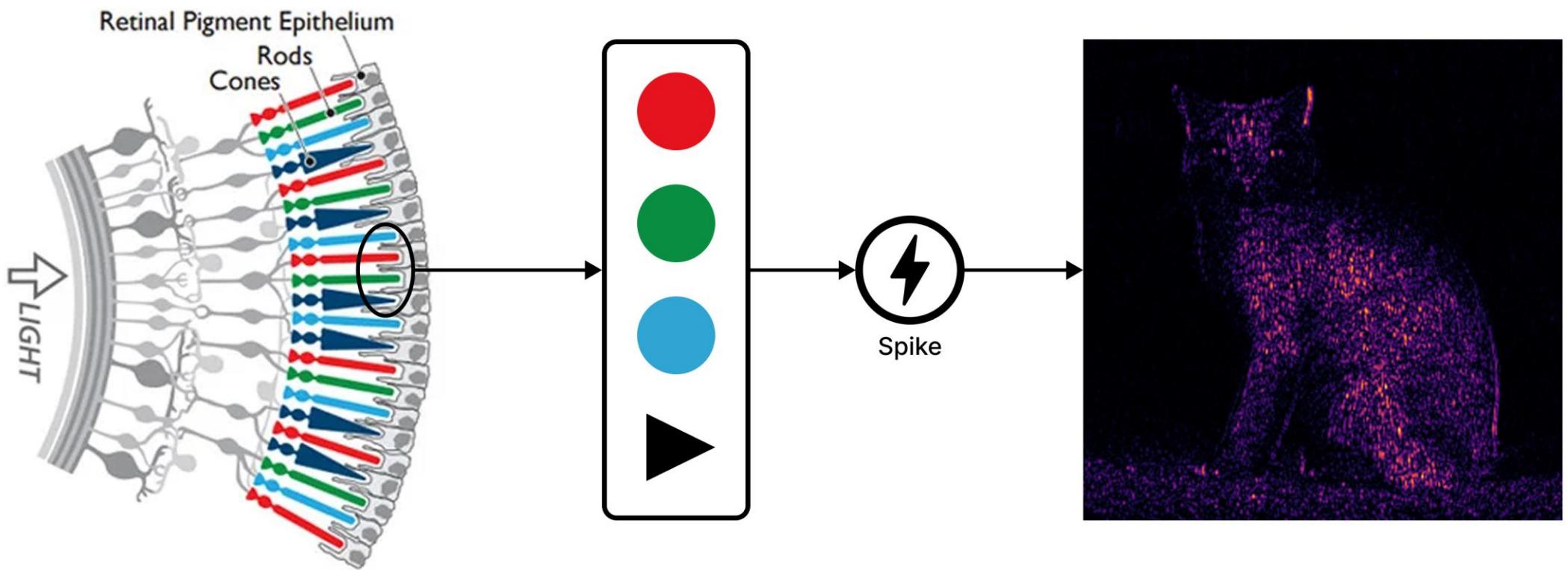


Fig: Extracting and encoding spikes to create neural pattern from light captured using IT

FROM LIGHTS TO SPIKES

VISION BABYAI

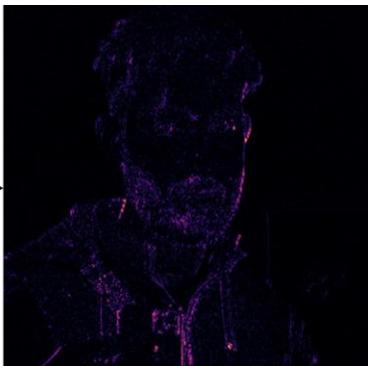
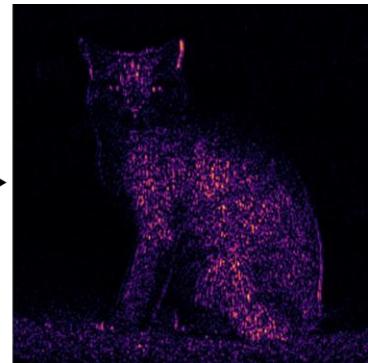


Fig: Spikes neural pattern generated on the basis of BabyAI Vision



SOUND TO SPIKE AUDITION BABYAI

- ✓ Cochlea → Neurons groups
- ✓ STFT → spikes
- ✓ Voice helix (memory)
- ✓ Dopamine reinforcement

JOURNEY: FROM SOUND TO SPIKES

AUDITION BABYAI

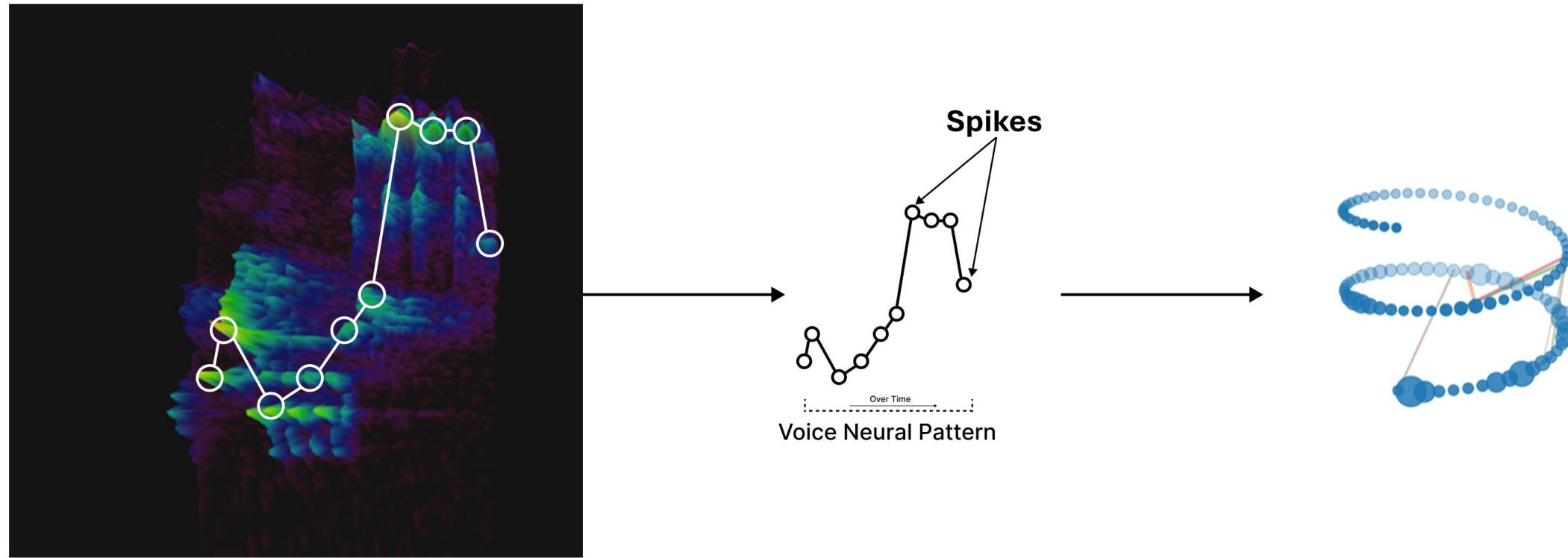


Fig: Extracting Spikes and encode to neural pattern from raw sound wave

FROM SOUND TO SPIKES

AUDITION BABYAI

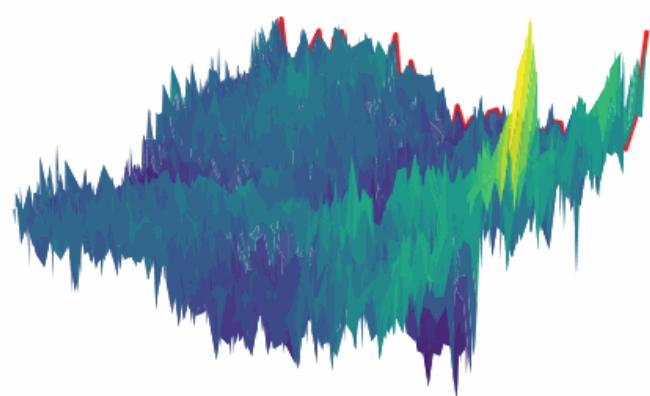


Fig: Sound Spectrogram

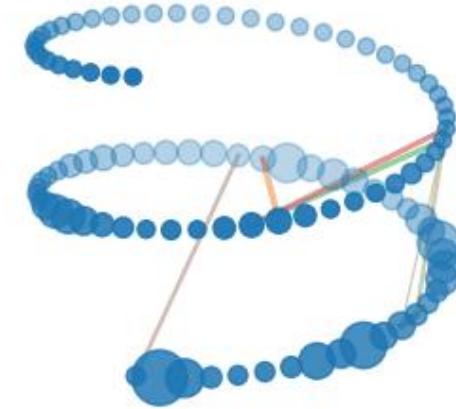


Fig: Neural Pattern

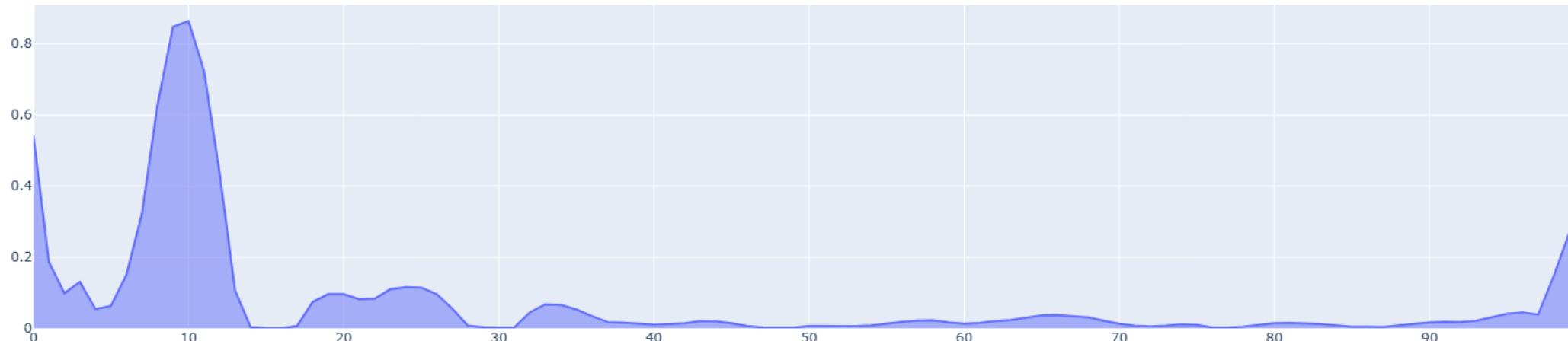


Fig: Sound wave frequency + amplitude pattern



NEURAL FIRING

BABYAI ARCHITECTURE

- ✓ Vision + Audition → Workspace
- ✓ Spike patterns + Plasticity
- ✓ Dopamine = curiosity modulation
- ✓ Prototype memory consolidation

NEURAL FIRING

BABYAI ARCHITECTURE

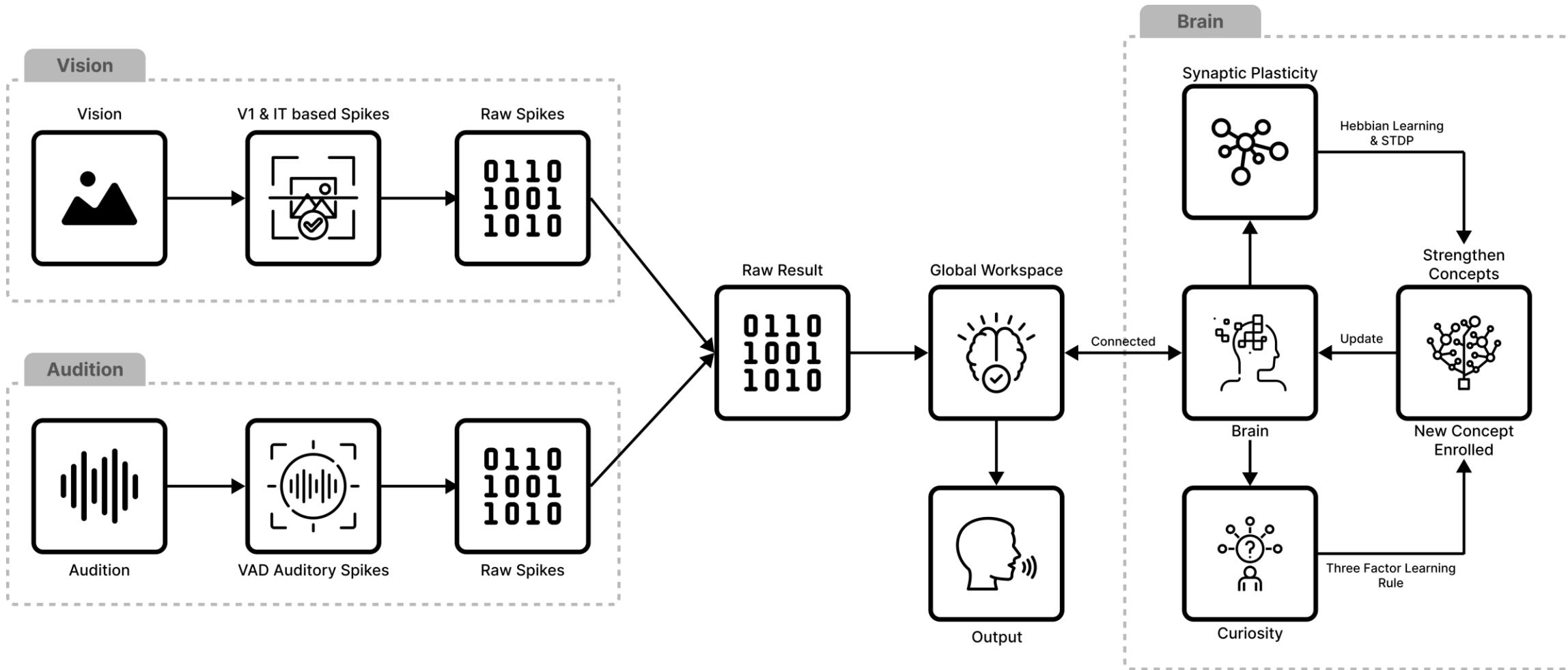


Fig: BabyAI Architecture

SIMULATING INTELLIGENCE

BABYAI SIMULATIONS

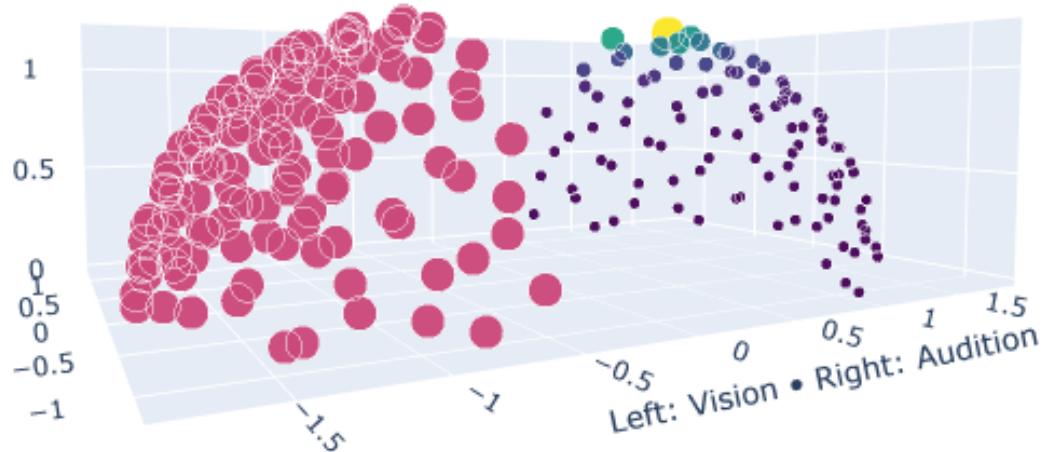


Fig: Neural Firing during predicting Sam

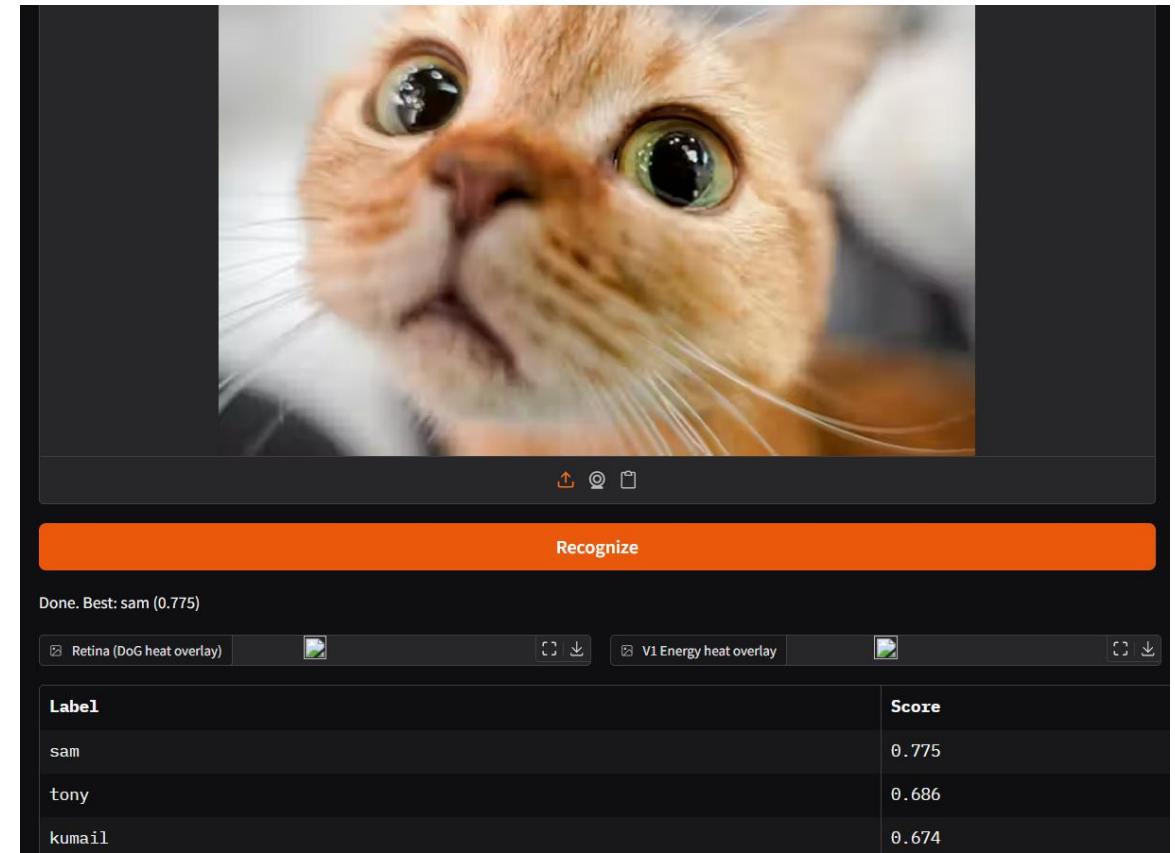
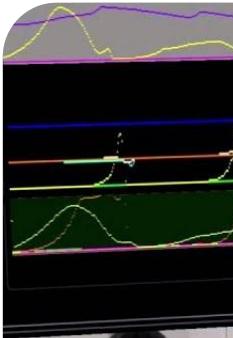


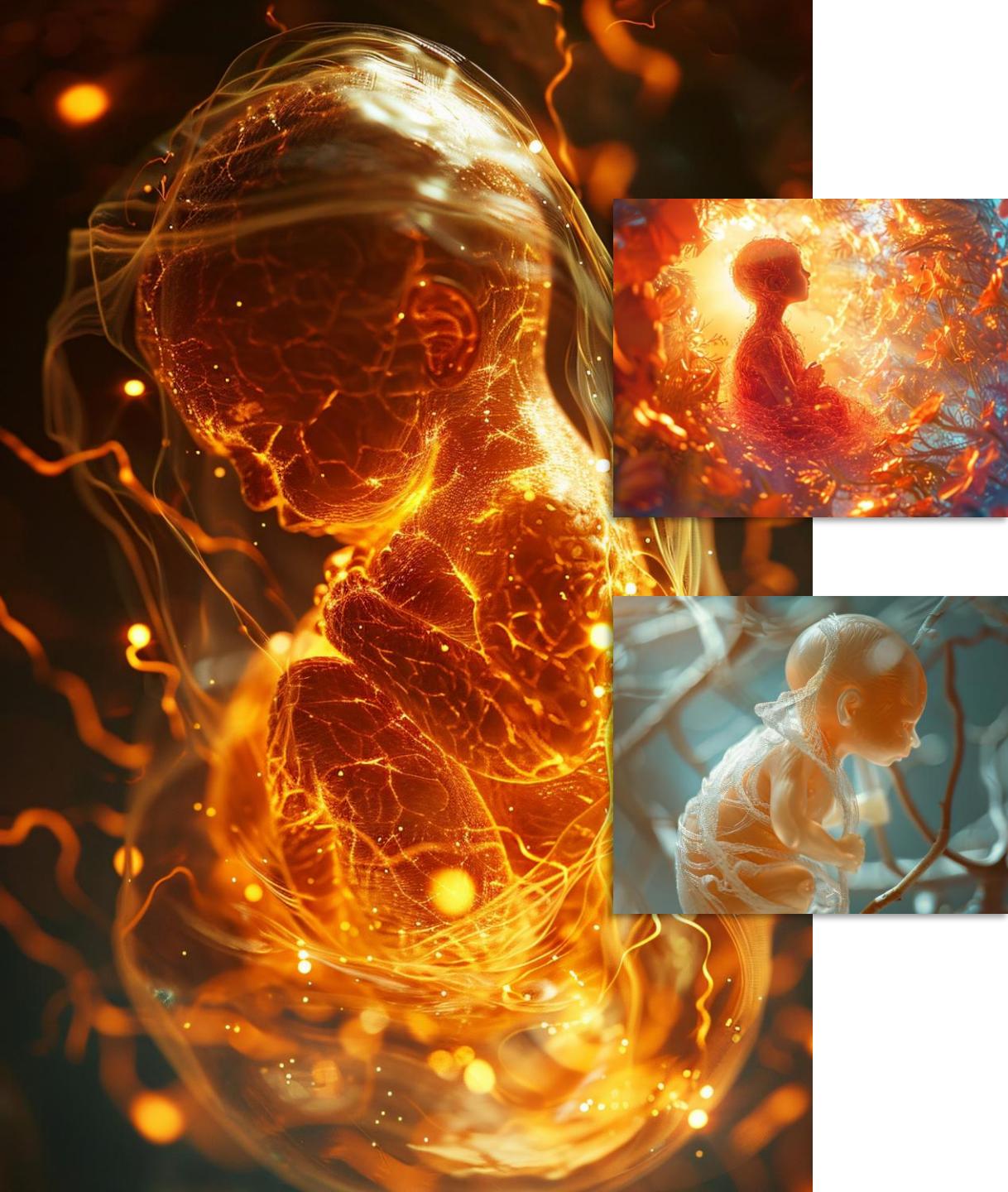
Fig: Predicting Sam

APPLICATIONS

BABYAI

- i. Adaptive robotics (online learning)
- ii. Healthcare assistants (personalization)
- iii. EdTech/companions (grow with user)
- iv. Neuroscience modeling





ACHIEVEMENTS

BABYAI

- ✓ Working multisensory pipeline
- ✓ Bio-plausible learning rules implemented
- ✓ Persistent prototype memory
- ✓ Live visualizations & demos



FUTURE WORKS

BABYAI

- ✓ Scale; only 2 senses; no embodiment
- ✓ Add touch/proprioception; sleep/replay
- ✓ Robot integration; larger studies





CONCLUSION

BABYAI

- ✓ Curiosity + biology → adaptive learning
- ✓ Senses fuse → meaningful memory
- ✓ BabyAI = step toward lifelong, open-world AI

QUESTION SESSION

ABOUT MY BABYAI

THE END