**✅ Title**

**AGI: Concept Arrays and the Cortex in an Implementable and Self-Sustaining Cognitive Architecture**

**✅ Abstract**

We introduce **SRS22**, a computational architecture for artificial general intelligence (AGI) grounded in a novel representational and predictive framework. The system is built upon three key constructs: **Concept Arrays**, structured groups of neurons that encode abstract features or perceptual concepts; **Concept Transforms**, deterministic operations that map data between Concept Arrays or between raw input/output and representational layers; and **Virtual Concept Arrays**, Concept Arrays emergent within the Cortex and formed over time through plasticity and learning.

In SRS22, Concept Arrays serve as the system’s evolving internal model of the perceived environment—the current state of “reality”—while the Cortex functions as a future-state predictor. These two subsystems interact continuously in an asynchronous loop: external inputs update the Concept Arrays via Concept Transforms, while the Cortex—driven by Virtual Concept Arrays—predicts the next state and feeds it back to stimulate the Concept Arrays.

Crucially, Concept Arrays are not statically tied to the present or future—they represent a fused, temporally blended state, interpolating between sensory input and predicted futures. This enables disambiguation, continuity under partial input, and internal simulation.

This work extends the foundational model from *“A New Model for the Cognitive Process. Artificial Cognition,” INBS’95* into a fully implemented architecture. Unlike conventional neural networks, SRS22 eschews gradient-based optimization and external training datasets, instead using local predictive adaptation to minimize internal prediction error. Implemented in C++, SRS22 is a self-sustaining, self-cycling cognitive system capable of perceptual abstraction, internal simulation, and emergent imagination.

**Code available at**: <https://github.com/RMKeene/SRS22>

**✅ Key Definitions**

* **Concept Array**: Structured groups of neurons encoding the current model of the environment.
* **Concept Transform**: Deterministic mappings from raw input/output to Concept Arrays and between predetermined Concept Arrays.
* **Virtual Concept Array**: A Concept Array emergent in the Cortex, formed through learning and plasticity.

**✅ Outline**

**1. Introduction**

* The challenge of building implementable AGI
* Overview of SRS22 and its foundational constructs
* Continuous loop: Concept Arrays ↔ Cortex
* Open-source codebase: <https://github.com/RMKeene/SRS22>

**2. Background and Foundations**

* Predictive coding, active inference, and internal modeling
* Summary of the INBS’95 framework
* Rationale for separating environmental state representation (Concept Arrays) from prediction (Cortex)

**3. Core Constructs**

**3.1 Concept Arrays**

* Arrays of neurons encoding specific concepts within the current model of the environment
* Support both a world actual state model and the imagined future state(s) model
* Defined as fixed, explicitly addressed regions within the global neuron array structure

**3.2 Concept Transforms**

* Deterministic mappings from raw input/output to Concept Arrays and between predetermined Concept Arrays
* Provide explicitly programmed innate concepts to the system that are fixed and not learned

**3.3 Virtual Concept Arrays**

* Concept Arrays emergent in the Cortex
* Formed over time through learning and plasticity
* Predict future Concept Array states based on internal dynamics
* Reinforced through recurrent activation and stabilized into long-term structure; otherwise subject to synaptic decay and structural pruning via cortical plasticity

**3.4 Cortex and the Predictive Loop**

* The Cortex is a regular (i.e., uniform) array of neurons
* Each neuron attempts to predict its own future state based on the current state of the entire system
* The Cortex is constantly learning
* Pattern matching across the Cortex is asynchronous and not synchronized
* The Concept Arrays are regions of the lower-address neurons

**3.5 Information Flow Overview**

* External Input → Concept Transforms → Concept Arrays
* Concept Arrays → Concept Transforms → External Outputs
* Concept Transforms compute their target Concept Array and stimulate to the computed state
* A neuron in the Cortex pattern matches the entire neuron array and stimulates itself to the expected future state
* **Neuron self-stimulation is proportional to the strength of match**
* **Neurons get fatigued if overused in a short period of time**

**3.6 Neuroplasticity Algorithm**

* Neuron connection weights adapt locally based on predictive error over time
* Frequently activated connections are strengthened; rarely used ones decay
* **Synaptic growth forms new connections semi-randomly when Synapses (Links) are available**
* Structural pruning removes connections with low utility or inconsistent prediction value
* Reinforcement mechanisms stabilize useful Virtual Concept Arrays through repeated predictive success

**3.7 System Balance**

* The system neurons have many settings such as decay rates, stimulus factors, aging factors, and more
* There must be a careful balance between Concept Transforms, Concept Array stimulation, pattern matching, stimulation from Cortex future-state prediction, and novelty of input and match
* What determines "novelty" is important
* In any Concept Array, **novelty** is any difference in stimulus
* In the Cortex, **novelty** is strength of match
* Neurons get **bored**
* Neurons get **fatigued**
* The overall goal is to **never fall into a steady state**, but to keep the system on the **edge of chaotic behavior**
* A **competing goal** is to **respond to the environment** and **avoid getting locked into an imagined world**

**4. System Architecture**

* C++ architecture, design goals, and performance constraints
* Neuron structures, data layouts, and memory models
* Tick scheduling and asynchronous update cycle
* Integration between Concept Arrays and predictive Cortex

**5. Implementation**

* Code structure and transform framework
* Local learning via predictive error minimization
* Tools for visualization and inspection
* GitHub repository: <https://github.com/RMKeene/SRS22>

**6. Demonstrations**

* Abstraction and recognition from low-level input
* Handling occlusion and completing missing input
* Prediction of future states through Virtual Concept Arrays
* Simulated imagination and continuity under zero input

**7. Theoretical Implications**

* **This is a continuously active AI, not waiting to be prompted**
* Alignment with biological cortex principles
* **Predicting the future as the basis for cognition**
* Departure from supervised learning and backpropagation
* Temporal blending and internal simulation as cognitive tools

**8. This is AGI**

* **Always awake and active**
* **Self-wiring and learning**
* **Aware of the environment and reactive**
* **Can internally plan in an iterative modeling of the world**
* **The algorithm explains all the aspects of human cognition**
* **The only limit is the size of memory, speed of processing, and input/output**

**9. Toward AGI**

* Comparison with transformers, cognitive architectures, and neurosymbolic systems
* Advantages: self-sustaining loops, real-time adaptability, internal modeling
* Open challenges: scale, embodiment, and interface generalization

**10. Conclusion**

* Summary of the architecture and its core components
* Recap of implementation and observed behavior
* Future directions and open collaboration
* GitHub link repeated for contributor engagement