**Non linear Dynamic Attention Allocation to Focus Probabilistic Logical Inference Upon Relevant Information**   
  
  
Probabilistic logical inference

logic and probability theory based on **uncertain and incomplete info**

1 **probabilistic inference** reasoning about likelihood of events occurring based on **prior knowledge using probability theory** from **incomplete and uncertain data**

2 logical inference d**eriving new facts and conclusion** from known premises using rules of logic

Introduction

Probabilistic logical inference (PLN) AND non linear dynamical attention with OpenCogPrime(OCP)

the goal is to achieve cognitive synergy (such as memory, reasoning and attention) assist each other

**Cognitive Synergy**

different **cognitive process**, **different types memory work togethe**r proactively and actively to in increase performance

1 Declarative storing factual information and concepts that can be explicitly stated or recalled.,

**Concept Blending:** Involves merging different concepts to create new ideas, **pattern creation**

**Procedural** execution of skill without **conscious thought** (mosses)

Reinforcement learning

**Episodic memory** pertains to **personal experiences and specific events**, tied to particular contexts like time and place.

**Eg Association and Pattern Recognition:**

**Attentional memory** focuses on how resources (like processing power or focus) ecan

integrate and support

**Atoms**  
Link one of basic structures used in atomspace used to define hyper graph .

they link two nodes it two nodes are the vertex in each node

link together with nodes called atoms  
1 Tree representation structural view

A WHERE is root of tree and two branches point to the Nodes "vertex A" b

LINK 1 root "A" "b"

2 Edge represent ion (graphical)

1 atoms get reward in mind agent if they are **useful in achieving there mind agent goal  
2 stimulus convert into sti and lti by importance updating agent**

**this is the currency collect rent,wages  
 lti rent to exist in atom space**

sti rent to exist in attention focus

3 sti spread between hebbian links spread by **importance diffusion gent and importance spreading agent  
  
Simple Importance Diffusion Agent : directly**

**between non-hebbian incident atoms, that is, atoms in the incoming and outgoing**

**sets of a source atom markove matrix   
  
4 hebbian updating agent update Hebbian link truth-value weather linked atoms in attentional value or not**

**symmetric Hebbian link unorderd**

**asymmetric Hebbian link orderd**

**inverse Hebbian link orderd**

5 forget agent remove below **threshold lti** and **isn't near any other important atoms**. (VLTI )

The latter condition is because the ImportanceSpreadingAgent

Forgetting can be tuned via two parameters:

1. the maximum LTI value that can be forgotten, and

2. the percentage of the AtomSpace to forget (typically this would be very low!)

6 hebbian Creation Module create new **asymmetric HebbianLinks as atoms are added to attentional focus**

The Hebbian Creation Module creates Asymmetric **HebbianLinks between atoms in the**

**AttentionalFocus for updating by the Hebbian UpdatingAgent**

1 proactive feedback

Cognitive process donor merely react to stimuli or infer one process actively influences another

**mutually assistive**

**donot work in isolation but assist one another**

work term memory limited capacity may be benefit from long-term memory contain vast information

**working memory temporally holding and manipulating information**

**problem solving reasoning and compression**

**cognitive synergy is the core design of openCogprime**

the system is comprised of highly interdependent for inference regarding patterns

visual, auditory ,uncertain reasoning

OCP complex disc two volumes

1 declarative learning component based on probalistic logic

2 attention allocation components

memory types in OCP

1 declarative

2 procedural

3 Dural

4 episodic memory

as well as attentional memory allocating system resource for generic manner

intentional memory allocating system resource goal directed fashion

Memory Type specific General Cognitive

1 Declarative Probabilistic logical network, concept blending pattern creation

2 Procedural MOSSES pattern creation

3 Episodic internal simulation engine association and pattern

4 attentional ecan association and pattern

5 intentional probabilistic goal hierarchy plan and ecan credit assignment and pattern

6 sensory DeSTIN deep learning association attention

dynamics of interaction between OCP

1 Knowledge can converted between two types of memory computational task \_\_>

2 when learning particular type of memory rate of learning is very slow it can processed to convert some relevant knowledge into representation of different type of memory cognitive synergy

Probabilistic logic Networks

probabilistic reasoning system with opencog more generally in agi

pln Bayesian probability theory fuzzu logic ,algothrmic theory

declarative representation within pln handled weighted labeled hypergraph Atom space

distention is made between rules and formulas forward and backward changing

Economic attention network

ECAN graph of untyped links nodes and links may or may be typed with Hebbian link

short term importance and long term importance as artificial currency

and importance value updating

importance concept of ECAN IS attentional Focus

atoms with the most importance particular instance

Evaluating PLN AND ECAN

1 crafting two test examples

A enough extraneous confounding data Ecan which many pieces of information reasoning system would choose to reason

b extraneous sequence of inference rule

2 designing appropriate measure of atom and rule usefulness

3 building testing bench for standalone para attention allocation system

The Test suite

1adding only extraneous data in form of test 1a

handlining more difficult data choosing pattern on inference rule

Surpassingness

measure of usefulness pattern deviation from expected value

|s-spop|

The ECAN Test bench

study and optimize parameters settings

-serious of controlled experiments to Test Ecan response to artificial controlled stimuli

desired behavior

-atoms in the attentional focus should pull atoms strongly connected to via Hebbian links into attentional focus

- atoms very weak and inverse Hebbian links in attentional focus should attend to pull the corresponding atoms out of attentional focus

the test Problem

integrating PLN AND ECAN IS attention allocation should guide itself probabilistic inference system

should choose atoms based upon their usefulness in answering

only useful information is

ECAN HELP

real world weights of rules inference (Implication links) via direct evaluation

or logical relationships learned from other source

a OpenCog’s frequent pattern mining algorithms [12] or

via OpenCog’s MOSES

Effective resource allocation needs to be demonstrated

not only across Atom choice, but in the much larger context of rule selection

and forward and backward chaining

--which atom is the best attention using ranking

Probabilistic Logical Inference (PLN):

PLN is the reasoning engine in OCP. It performs probabilistic reasoning based on uncertain knowledge using a combination of mathematical foundations and heuristic rules.

Key Features:

Declarative Knowledge Representation: Knowledge is stored in a data structure called the Atomspace, a hypergraph where nodes and links represent concepts and relationships, weighted with probabilistic truth values and attention values.

Inference Rules and Truth Calculations: PLN employs syllogistic rules (e.g., deduction, induction, abduction) to infer new knowledge by combining existing statements.

Forward and Backward Chaining:

Forward Chaining propagates known facts to generate conclusions.

Backward Chaining starts with a goal or query and traces back to relevant facts.

ECAN identifies and highlights the most relevant Atoms based on their importance.

PLN uses this filtered focus to:

Reduce computational overhead by ignoring irrelevant data.

Enhance inference accuracy by concentrating on high-value information.

ECAN’s attentional focus actively directs PLN’s forward and backward chaining processes to paths most likely to yield meaningful inferences.

Example:

In the Smokes Problem test:

Extraneous data (e.g., random nodes, links, and irrelevant facts) was added to simulate real-world noise.

Without ECAN, PLN struggled to focus on relevant facts, leading to reduced performance.

With ECAN, the system prioritized important nodes (e.g., people directly connected in the "Friends" graph or those with relevant smoking data) and ignored the noise, producing accurate results efficiently.

Workflow:

ECAN Filters Information:

Identifies which concepts or data points (Atoms) are most relevant based on STI and LTI.

PLN Operates on Focused Data:

Performs inference only on high-priority Atoms, improving efficiency and accuracy.

Feedback Loop:

PLN updates relevance scores in ECAN based on inference outcomes, refining focus over time.

Benefits:

Improved Reasoning Accuracy: PLN avoids noisy or irrelevant data.

Resource Efficiency: ECAN reduces computational overhead.

Real-Time Adaptation: Both PLN and ECAN adjust dynamically to changing goals and datasets.