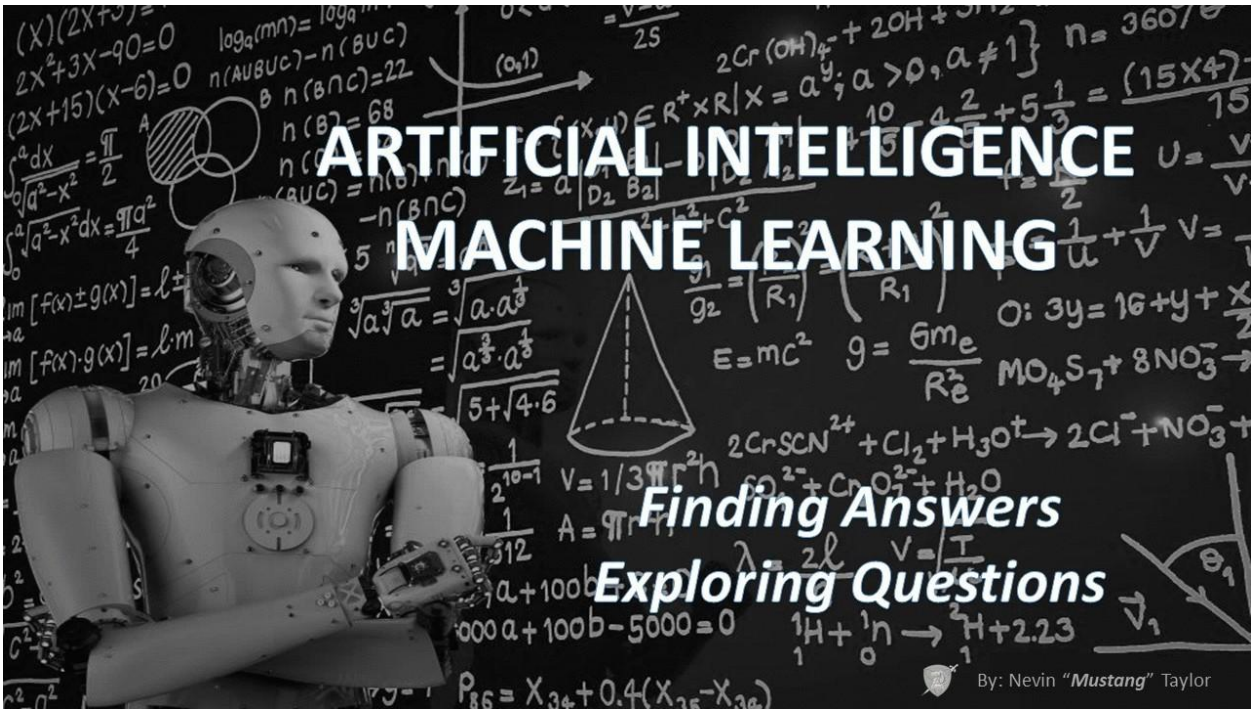
Artificial Intelligence/Machine Learning



Finding Answers/Exploring Questions *By: Nevin "Mustang" Taylor*

From its inception in 1955, Artificial Intelligence (AI), coined by economist Herbert Simon, quickly grew into science fiction, where computers came to dominate the status quo with superhuman intellect, putting the existence of mankind at risk. Stating outlandish predictions and postulating that they could produce systems that would outthink and outpace humanity fueled doubt and speculation. History has illustrated the trepidation and challenges associated with technological advancements and the establishment of autonomous systems. Even now, the prospects of AI are approached with a high degree of skepticism. This creates not only cultural impediments but also technological challenges in overcoming the fear associated with empowering machines to become self-sufficient. In time, fiction is rapidly becoming reality with the inception of Watson's 1997 victory over chess master Gary Kasparov. A new age is being ushered in, with the prospect of establishing a collaboration between humans and machines as we begin to utilize and leverage these technological tools to gain a competitive advantage on the world stage.

Science is embarking on a journey to explore and empower machines with capabilities once unimaginable. Today, AI has evolved and become a part of our everyday existence. It continues to mature and conquer unforeseen capabilities as it provides a multitude of opportunities to improve our quality of life. Through new applications such as self-driving

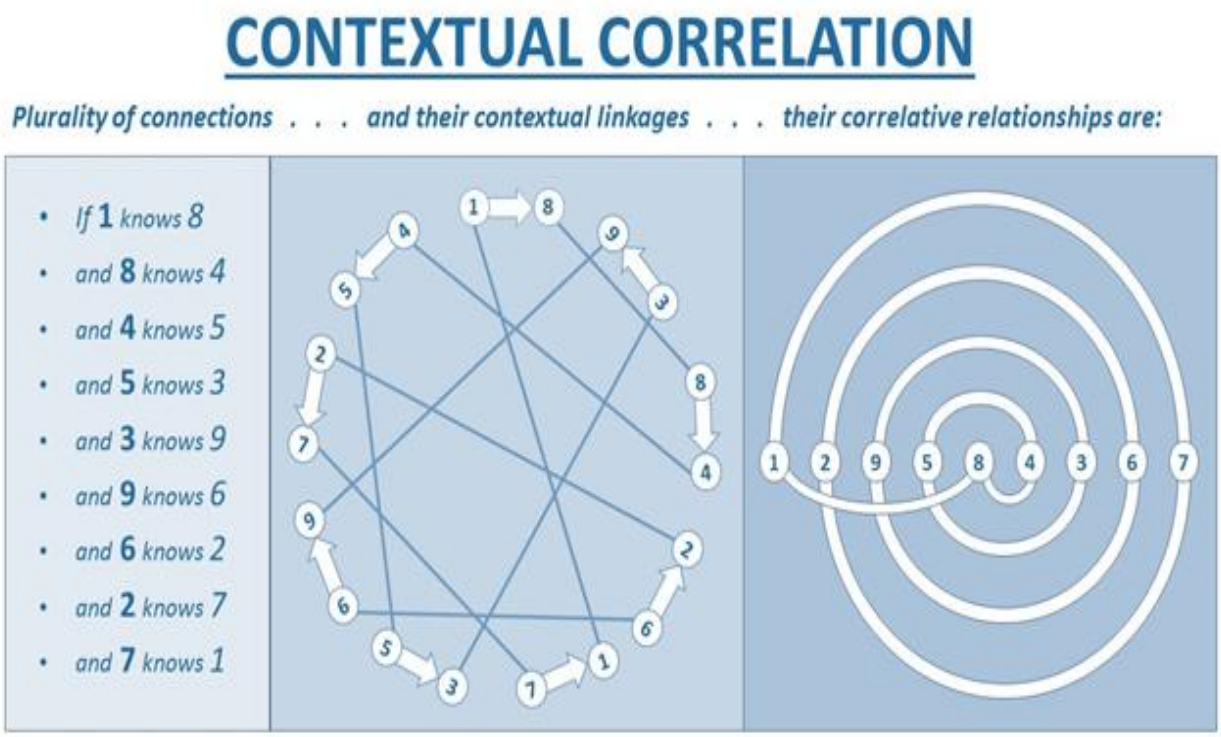
cars, AI is being integrated into every aspect of our existence. Through a multitude of varied and diverse technological applications, it is driving the evolutionary process of transformation. Interaction can be seen in a plethora of venues, such as those in call centers. These conversational engagements leverage AI in an advisory capacity through business intelligence systems to communicate, coordinate, and collaborate with customers. The collected information is then correlated to support the cognitive process that underlies the evolution of contextual understanding.

By applying advanced decision support systems, AI can empower self-synchronizing systems, allowing it to mature and expand its applicability beyond traditional boundaries. There is a growing acceptance of this, which is fueling an innovative approach beyond historical conceptual boundaries. As acceptance grows, the sensationalistic view that computers will exceed humans is falling by the wayside. AI is now being embraced at all levels to leverage collaborative partners in an effort to increase cognitive capacity which derives increased competitive advantage. Through the art of the possible and the science of the relative to how AI will evolve and be implemented in today's technologically savvy society, the intersection between art and science has only become constricted by our own creativity.

We must establish a common understanding of what AI is if we are to preclude self-imposed limitations that restrict its proper application and impede potential progress. By defining AI as "analytical information," its potential is more constructively and purposefully realized. This approach will help properly apply this technological tool to unleash the inherent power of information effectively. Leveraging analytical information through an algorithm offers the opportunity to consistently apply facts constructively via a machine-to-machine process that capitalizes on the consistency to ascertain causality against resulting consequences. Under this construct, we can use this predefined technology framework to measure available facts against desired outcomes. It is through the appropriate operational application of AI that we can fully capitalize on its capacity to assist and align knowledge in ways that facilitate cognitive processes.

AI is currently constrained to leverage knowledge only to answer today's perplexing questions. Therefore, it is through this process that machines are empowered to provide answers to computational formulas through predefined algorithms. Thus, their ability to derive answers within the framework of formulas precludes their ability to make decisions. Therefore, it is within this area of autonomous interactions that they assess the answer given the question being asked. Their inability to characterize or put into context the circumstances upon which their answer is presented currently precludes their ability to evolve. Given limited insights, they are restricted to providing contextual correlations from

limited transactional machine-to-machine actions. Thus, they can only apply those facts through predefined dependencies to compute probabilistic determinism to ascribe answers to predefined suppositions. As the system grows and evolves, it becomes more complex, and the resulting interdependencies become more challenging to conceptualize. Human interaction is slower, and error rates are higher than with their computerized counterparts. Machines can compute analytical information more accurately, responsively applying the assigned variable to derive correct answers with minimal degradation to throughput consistently.

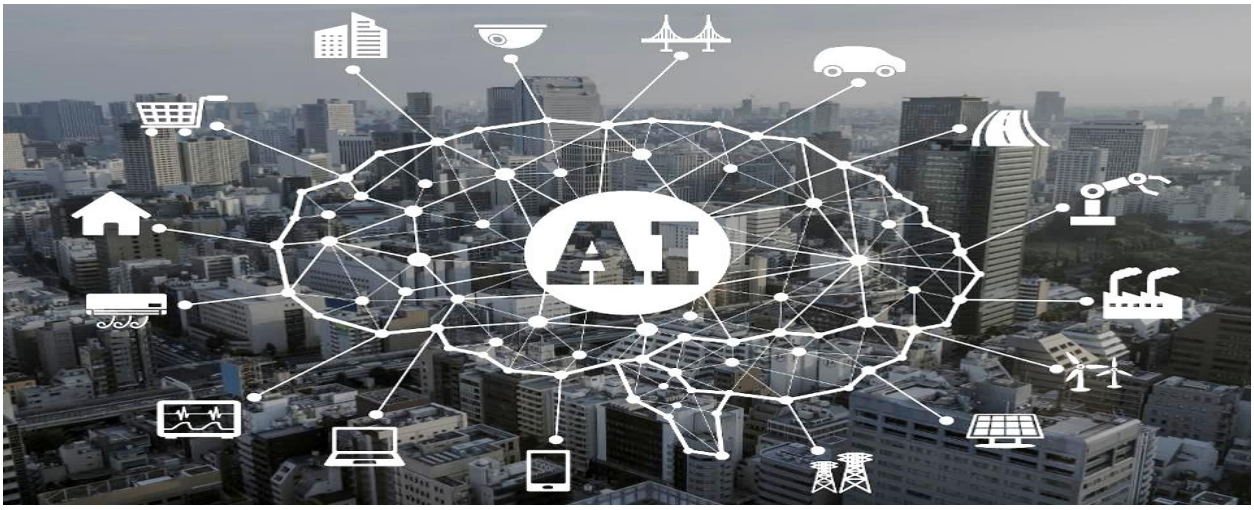


The opportunity to provide a contextually rich and colorful picture can elevate awareness. Given the temporal nature of this effort, we can begin measuring adaptation and apply a 3D model to ascertain causality, preparing for and predicting consequences by validating the knowns, unknowns, and yet-to-be-realized unknowables. It is through this contextual picture that we derive heightened situational awareness (SA) to validate our knowns, assess the unknowns, and explore the potential of the unknowables in our ongoing efforts to evolve and expand knowledge. Through a conceptual engagement of relational comparatives, we can apply and mature our SA through exploration of diverse perspectives. By using this process, we can begin to derive opportunities to compare differences, distinctions, and differentials (3D) to create a rich, fully encompassed picture or perspective, upon which to establish and expand our understanding of current circumstances through our ongoing efforts to grow, learn, and evolve.

Comparative analysis has been utilized for some time with great results. This is demonstrated in the current process that allows machines to read. Through optical character recognition (OCR), machines can analyze and match shapes to approximations of letters in the alphabet. Further application of this and other similar capabilities is being performed with higher accuracy on pictures, given the additional contextual information provided by a more diverse comparative advantage and greater relative references in both shapes and colors. Efforts to bridge the gap between humans and machines have attracted significant interest as of late, with advances in machine translation and natural language processing enabling more seamless interfaces. An instance of these capabilities is readily utilized in today's call centers, where human voice interactions enable audio interpolation via modulation comparisons to provide almost instantaneous matching of words to meaning. With continued research, they will undoubtedly be able to characterize sentiment through implications and, as a result, timing to determine contextual understanding that provides a full range of said and unspoken inferences.

Even with a plethora of advances and increasing interest in this area, AI is only as good as the data that is provided. Thus, we must be mindful of the adage all too familiar to computer programmers: garbage in, garbage out – GIGO. Given the many new social data sources that continually coordinate, collaborate, and communicate the evolving nature of today's information, the need to time-slice to ensure capture and processing is essential. The maturation process of information has become an iterative, constantly changing endeavor, often amplifying the worst that badly correlated information has to offer, given poorly constructed data. Has proven to be an excellent means to mature and to garner current perspectives, which, in turn, transform paradigms. It is this opportunity within the dynamic environment of the digital domain that the collaborative approach seeks to enlighten the community, empowering the maturation process to transform perspectives and paradigms and offering the means to evolve knowledge beyond current understanding.

A continuum of assessments is a valuable resource, unlike the traditional medium for authoritative sources like encyclopedias. The speed at which these capabilities were revealed in 2005, as online social information sources proved to be comparable in quality to their historical references. An Oxford University 2012 study further identified advances in technology to provide contextual and timely data that was of equal or in some cases better quantitative and qualitative accuracy. The results of improved veracity and currency have improved despite our lack of trust in social media. The proven reliability of this venue continues to catalyze the transformative nature of data that matures and informs the cognitive process. In today's highly interlinked world, the resulting dynamic of transformation requires a continuum of adaptation to notify the results of iterative influences on today's information environment.



The timeliness of information has become a vital element in the cognitive process of making informed decisions. The two essential factors that AI relies upon to inform and make enlightened decisions based on elevated situational awareness are found in the ability to adapt to circumstances as they influence this highly adaptive, yet highly interdependent, digital domain. This has created a confluence of data with ever-increasing demand signal and dependence, the totality of which is doubling every two years. The result is a volume of data that provides information to inform contextual knowledge. The expansion of this phenomenon has accelerated, transforming our understanding and perspective in this highly adaptive environment. One must be mindful of the value proposition as it relates to their ability to assess the strategic trade space in terms of actual/quantifiable and opportune/causal cost-benefit considerations, for it is in their ability to effectively plan and efficiently program in consideration of the necessity to be flexible in this dynamic highly evolving environment that is foundational to their ability to capitalize on options and available opportunities essential for strategic advantage.

To be competitive in today's information environment, which is transforming at the speed of mission, one must be adaptive to actualize opportunities in the new age of knowledge. This requires large sample sizes (**Volume**) with sufficient diversity (Variety) to adequately characterize interdependencies and assess quality (**Veracity**). It is thus imperative that timely feedback (**Velocity**), is provided to sufficiently contextualize knowledge to inform understanding throughout all stages of operationalizing data in a way that serves the organization (**Value**). The maturation of these five measures informs how to assess data, characterize information, and properly mature and enlighten, empower, and evolve (ACE) mission objectives. Business intelligence can define the available trade space, illuminating options and illustrating opportunities to capitalize on. It is through this that organizations become enlightened and empowered to make better decisions, thereby evolving their ability to gain and maintain on the interlinked global stage.

It must be understood that AI is about providing answers given our awareness of current circumstances. The quality of the answers has direct forbearance on the quality of the facts and the context upon which they are presented. Thus, AI is the opportunity to correlate knowns through relative validation and the codification of unknowns in an effort to explore unknowable's in a way that evolves understanding. It is this consistent approach that characterizes the environment to ascertain causality and the resulting consequences of actions taken, measured against the results to be achieved. Machine Learning (ML) serves as another recent infatuation previously coined by Arthur Samuel in 1959, based on a study of pattern recognition with a focus on computational learning. As it pertains to the ACE model (Assess, Characterize, Enlighten, Empower and Evolve), assessments are accomplished via AI and Characterizations are through ML.

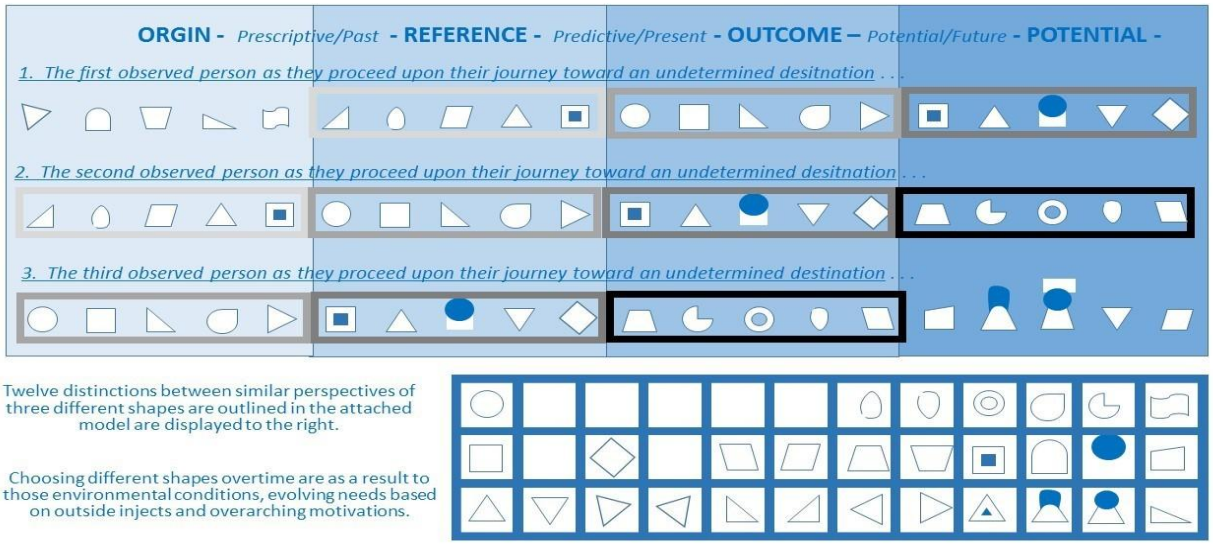
The evolution and adaptation of transformations reveal an insightful understanding that enlightens the recipient of those options and presented opportunities as they reveal themselves. It is this temporal study that is at the core of ML. Whether supervised or unsupervised, the framework for referencing these adaptations is the trend that affords those influences within the environment the causality to produce the resulting consequences that lead to outcomes. It is through our understanding of how the causality of actions results in consequences, as illustrated by John Boyd's OODA loop, that we gain insights for learning and looping.

It is from this perspective that decisions can be made based upon available options which are acted upon given current circumstances in an effort to This process of Observe, Orient, Decide and Act (OODA) relies upon an iterative approach to learn infused with a Loop. It is through this adaptive approach, that the opportunity to learn in this highly dynamic domain present the means to evolve and transform. For in time, trends are identified through temporal assessments that illustrate cause and illuminate potential consequences which the source the aforementioned options and opportunities.

Recently, algorithms have been developed to measure adaptive correlations, allowing us to quantify relational dependencies. It is these computational algorithms that provide insights to the interdependencies within both the open and closed systems. The resulting relationships can be assessed to determine how they adapt and evolve. It is from these insights that the requisite questions essential to effectively exploring the environment of the knowns, unknowns, and unknowables can be ascertained. In terms of time reference, temporal analysis can now correlate information to place it in a contextual framework.

The alignment of associations that interdependencies can be measured over time to illustrate adaptations. By measuring adaptive correlations, we can begin to see trends and thereby assess what the future holds. The forbearance of facts, factoring in how they relate to each other, offers, for the first time, an assessment of the influence actions have on current conditions and how that manifests in creating the impetus for our impending future state. As illustrated above, contextual correlation utilizes the relational frameworks to provide answers. However, it is through adaptive correlation that we can demonstrate how to capitalize on insights that inform us about the future, resulting from the interdependencies of past and present interactions, as illustrated in the following model.

ADAPTIVE CORRELATION



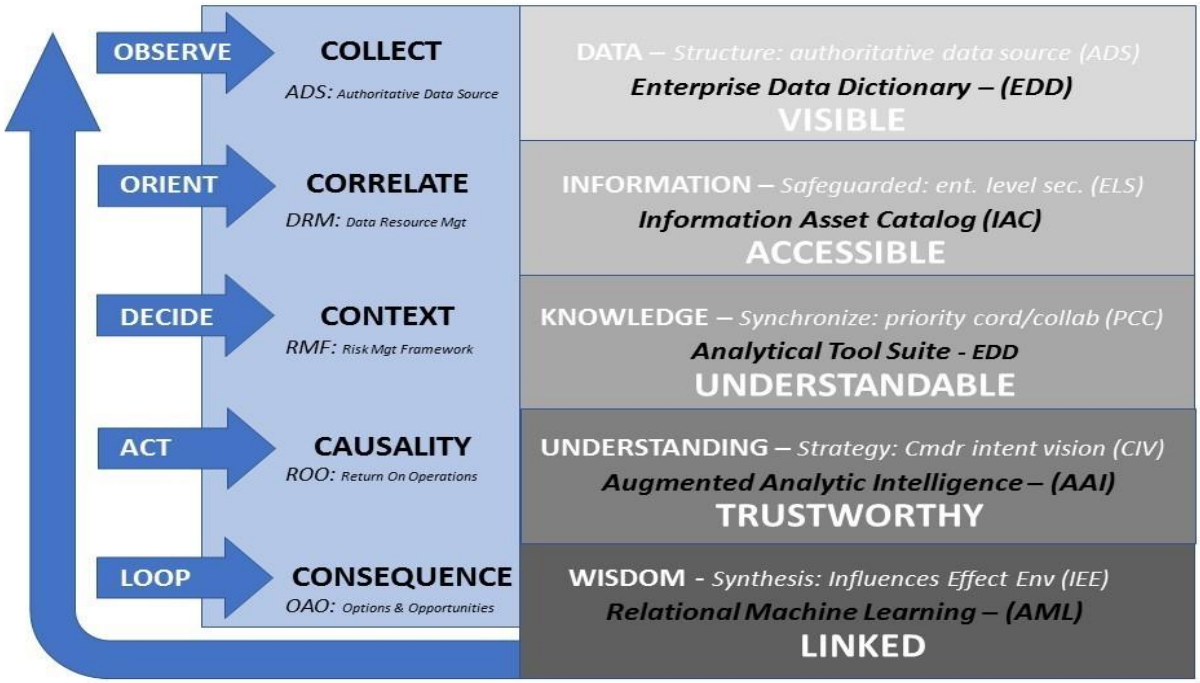
Twelve distinctions between similar perspectives of three different shapes are outlined in the attached model are displayed to the right.

Choosing different shapes overtime are as a result to those environmental conditions, evolving needs based on outside injects and overarching motivations.

Most machines were initiated via supervised learning. The fallacy of this approach is that it adopts pre-established parameters confined by paradigms that preclude a progressive journey of exploration. It is through this effort that systems seek to understand the dynamic characteristics of a constructive environment in a vain attempt to produce progress. Unfortunately, this effort instantiates a polluted perspective given the cognitive bias associated with current paradigms. By restricting the ***collection*** of data and guiding how information is structured/***correlated***, the distillation process incorporates any preexisting flawed perspectives into the new ***contextual*** understanding. Thus, as the information is distilled from the original premises, the regression of data incorporates potential inaccuracies affecting the ***causality*** of current assessments. This is compounded by the ascribed pre-defined framework, which creates a multitude of intertwined dimensions that are distracted by irrelevant factors, including unintended ***consequences.*** The inclusion of external noise and false positives further convolutes the outputs, creating disconnected results.

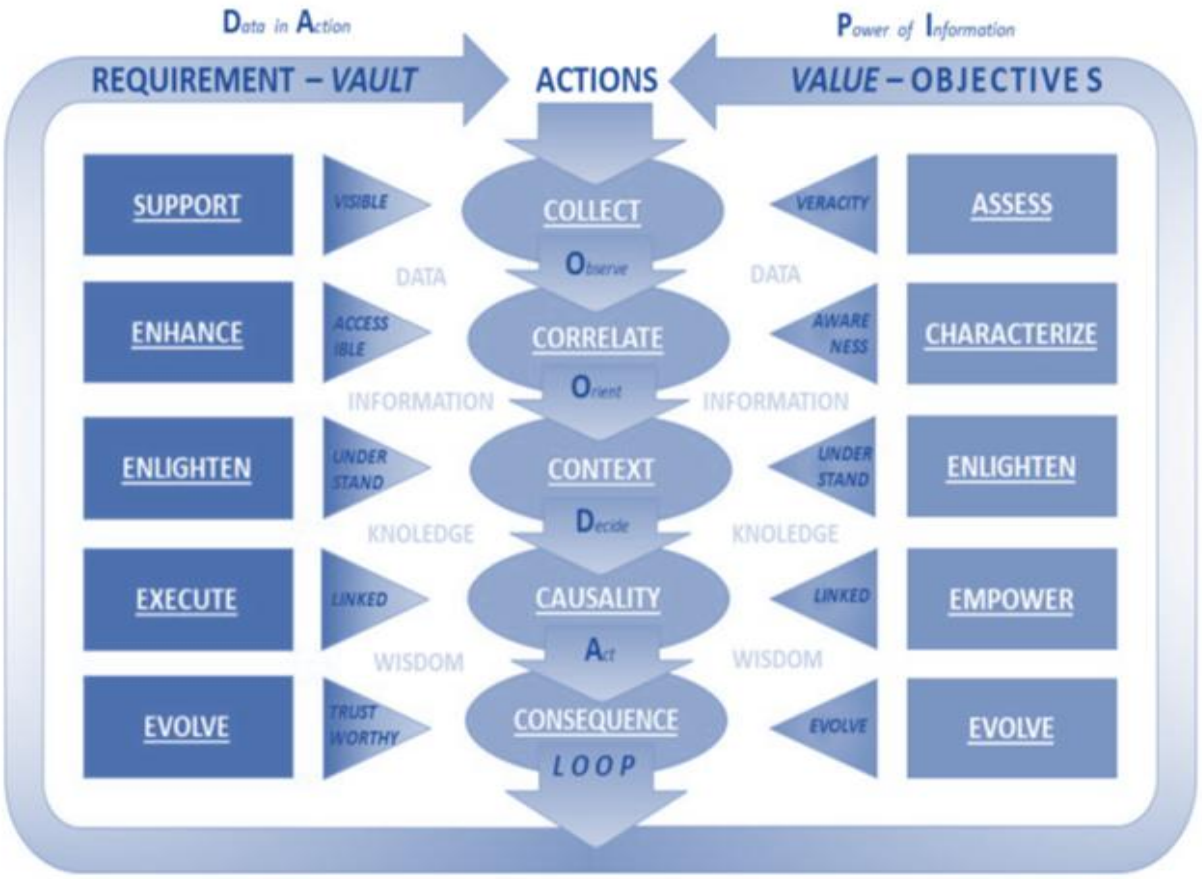
Under the supervised model, the pre-deterministic objectives to be served, coupled with a static framework, preclude the opportunity to learn and evolve unencumbered by existing suppositions. Irrespective of how things are collected, correlated and cataloged, regressions are accomplished utilizing flawed, incomplete, or inconclusive data which precludes effective outcomes/assessments. For as the data is clustered, the resulting inductive bias is attuned to leading the witness from contradictory realities in today's volatile, uncertain, complex, and ambiguous (VUCA) environment. Given the growing mass and resulting complexity of it becomes imperative that it is operationalized to substantiate a strong and sound foundation of fact. This is accomplished by registering authoritative data sources (ADS) to deconflict and assess its quality (Veracity).

COGNITION



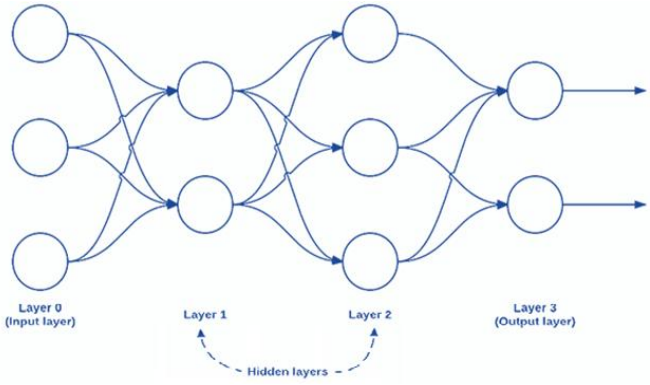
An enterprise information model must be established to provide a standardized approach to collect what they observe so that it can be discoverable (**V**isible). By deconflicting the data, and demonstrating its pedigree, the opportunity to assess its veracity offers the means to establish an enterprise data dictionary that assures a standard definition. Once the data is structured so that it can be searchable (**A**ccessible) through an information asset catalog, it becomes useful and shareable throughout the enterprise. It is this process that ensures that the facts and relationships are assembled to illustrate contextual knowledge (**U**nderstanding) that informs the cognitive process. By correlating (**L**inking) facts and relationships to decisions, increased confidence (**T**rustworthiness) allows the **VAULT** of Understanding. The result is the quintessential foundation for a machine-to-machine framework to perform autonomous processes, affording the exploration of options and opportunities to learn and evolve.

Illustrated below the assessment and the interdependent adaptive correlations as they evolve over time. The resulting trends, illuminated through temporal analytics, provides the opportunity to characterize the environment in a way which allows heightened awareness and enlightened understanding. It illustrates the differentials of the origins and distinctions of the references (prescriptive modeling), provides probabilistic outcomes or determinations (predictive/causality modeling) and informs future potential deterministic (possibilities/consequence modeling) against options and opportunities.



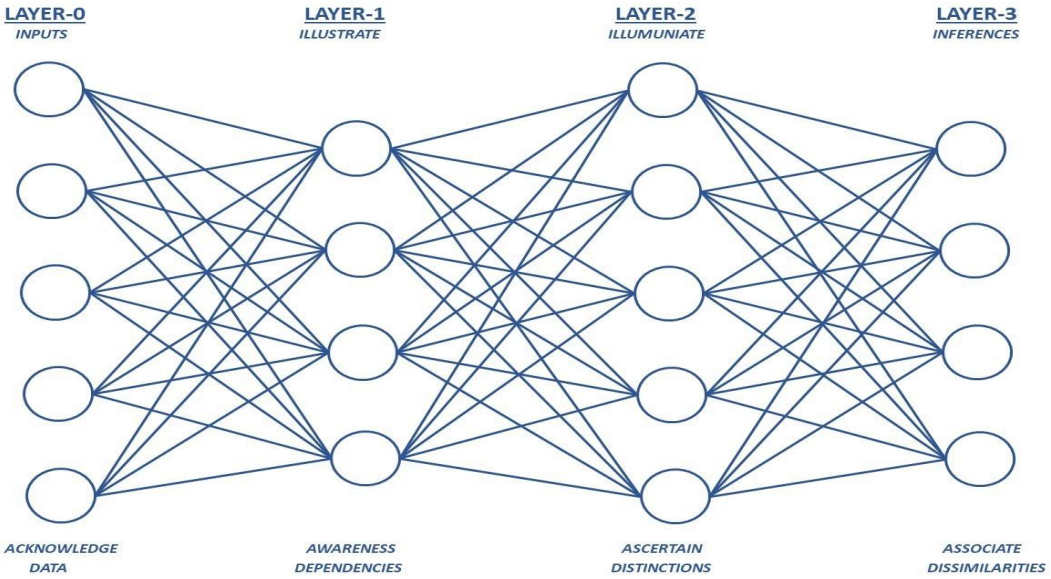
In the illustration below the complexities are explored in layer 1 to determine the interdependencies. In layer 2 the distinctions are identified so that the comparative analysis can be displayed in layer 3. The value of this process presents a better understanding of the interdependencies relative to the relationships between dissimilar pieces and parts It associates their common denominators are a part of ascertaining the mass and complexities of the expanse of options and opportunities. In the simplest of terms, when comparing two objects, the neural network ascertains from inputs an illustrative illumination of their dissimilarities from two differentials to perform a comparative analysis upon which to learn the dependencies they share, the distinctions they possess and differential that exist within their ecosystem as illustrated below:

- **Layer 0** *inputs that are distinct*
- **Layer 1** *illustrates the dependencies*
- **Layer 2** *illuminate the distinctions*
- **Layer 3** *infer the dissimilarities*

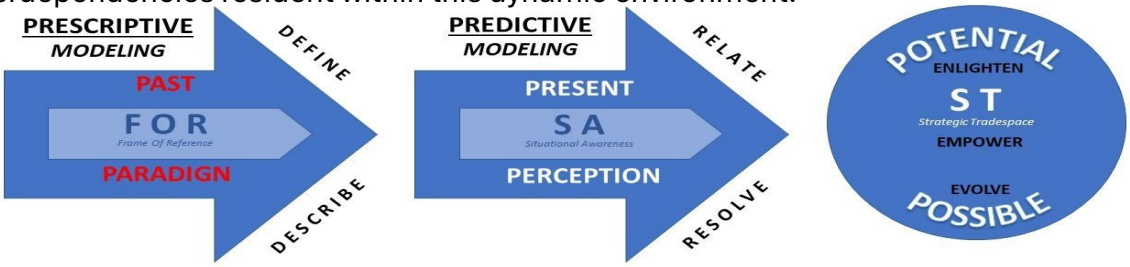


Complexities of this increase exponentially as more inputs are captured. Something as simple as comparing five inputs required 25 substantiations to understand the IADs (Inputs/Illustrations/Illuminations/Inferences, Acknowledge/Aware/Ascertain/Associate, and Data/Dependencies/ Distinction/Dissimilarities). The following graph illustrates how the system effectively models and builds out the procedures by quickly processing near real-time assessments to acknowledge dependencies, ascertain the dissimilarities (3D).

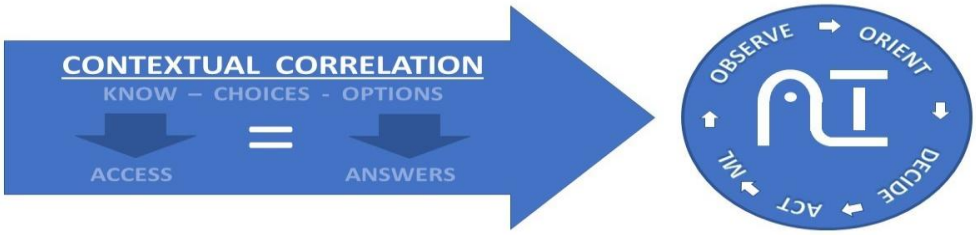
The system becomes enlightened through pre-established frameworks that provide a referential framework for deriving understanding from interdependent causality, employing restricted learning. By allowing the system to self-synchronize, we begin to appreciate the interdependent dynamics and gain insight into how to interact with and exist within the environment. Through an iterative approach exploration, the opportunity to apply active learning produces a competitive advantage.



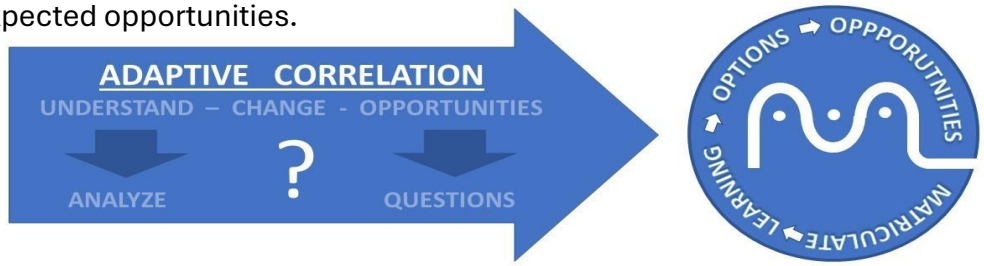
By capitalizing on this approach, we can infuse an adaptive process through the aforementioned efforts to think big, start small, and scale quickly, incrementally progressing toward maturity and building momentum. It is within this proactive procedure that we can build on the current state, informed by past activities, to arrive at the desired future state. By measuring progress over time, we can determine the feedback required from the OODA Loop to produce the essential inputs that influence, effect, and evolve the transformative environment in a way that meets our desired end-state, given the interdependencies resident within this dynamic environment.



It is important to note that AI's focus upon answers is very different from ML's exploration of questions. Often, many try to expand AI through ML. Given the context of AI, it offers elevated SA to derive an understanding that informs ML. But it is the temporal adaptations over time that present the quintessential trends to educate the future. As options and opportunities are explored, the journey of exploration informs the causality of our actions, leading to natural consequences measured against the results to be achieved. Thus, AI solves for "X"." In contrast, ML iteratively transforms the vector/direction and velocity/timing of our FOR of past actions relative to the current SA and the desired future state. It is through this progressive process that we begin to characterize the environment to expand beyond our current understanding of those things we are unaware of, which are unknowable, to evolve knowledge that surpasses understanding.



This has recently been demonstrated in technology's ability to achieve intuition and garner victory in the ancient stone game GO by Alpha GO. The first iteration developed via supervised ML was sufficient to achieve victory over the world's GO Grand Masters. The later version Alpha GO was an unsupervised ML system, that achieved victory from its own predecessor by figuring it out for itself the options and opportunities for victory. This illustrates the benefits of exploring options and opportunities (questions) rather than probabilistic assessments (answers). Despite counterintuitive actions, one quickly realizes that by capitalizing on the potential to learn through failure, or falling forward, they are assured the necessary flexibility to derive victory as you seek unforeseen options which deliver unexpected opportunities.



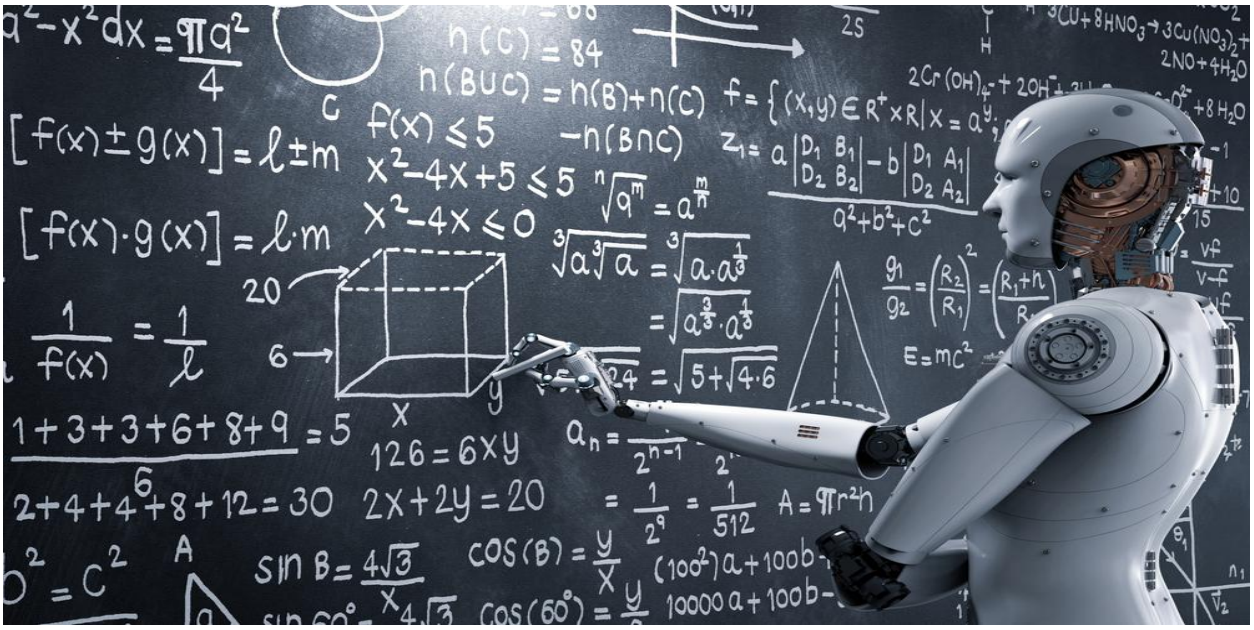
By adopting the postulates of unsupervised machine learning, we are afforded the means to derive new assessments unimpeded by past paradigms. This approach ascribes to the value of relationships attune to the neural nets that create and mature over time associations and linkages as illustrated in of Hebbian theory. Focused upon interaction associated with the influence and effect of paradigms and perceptions, the resulting realities create unencumbered progress throughout the validation that occurs throughout the learning process.

The result is artificial neural networks that can more effectively illuminate, empower, and evolve the cognitive process. With an emphasis on harnessing potential, the strategic goals and operational objectives become the focus, driving sacrifices to achieve results. Today's increased interest in exploring the view of a computer unencumbered by human intervention offers new, unforeseen opportunities to evolve undistracted by cognitive bias. These unsubstantiated suppositions create a new self-forming paradigm validated in fact.

Through the success demonstrated in this area, we see the applicability of generative adversarial networks to assess and characterize their environment in its current state in order to enlighten, empower, and evolve (ACE) the VUCA environment in the enveloping future state. By applying context and understanding the correlative adaptation, the evolutionary and transformative perspective will unlock the vault of understanding. It is at this point that we can begin to determine causality and the resulting consequences, in order to derive the value proposition of the actions taken, measured against the desired results to be achieved.

Thus, through unsupervised machine learning and are best suited to adapt, evolve and transform the environment to meet current and future objectives. The power of ML has thus been underestimated for it serves as the catalyst to tap into the creative capacity of artisans like Rembrandt and bring his creative capacity back to life. The program “The Next Rembrandt” illustrates how contextual and adaptive correlation is applied to produce a painting that would rival the master. This, combined with systems that have demonstrated the ability to learn and evolve beyond the prescribed environment, as illustrated in the Cyber Guardian Challenge, brings fiction to reality in our brave new world.

Current Deep Belief Networks can now assess the impact of aggregation and possess the potential to create code that transforms and evolves from self-sufficient learning. The influence and effects these recent technologies have on our environment demonstrate ML's ability to transform technological systems and grow beyond their circumstances. All said, one begins to question if systems that incorporate these features into a collective interconnected system could not soon fulfill the parameters of a sanctioned being.



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