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The Art in Artificial: Locating the Artist in Machines

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Abstract

With the advent of artificial intelligence there is very little that is left outside the purview of it. Art making, a specialism of human expression, is also something AI is venturing upon. The present paper is an attempt to analyse and contextualise art making in artificial systems. The study envisages to look into the ways and means by which these machines are able to make art and how in the present-day context are not just competing but also sometimes faring better as compared to human made art.

Keywords: AI art, deconceptualisation, juxtaposition of dissimilar, aesthetics

1. Introduction

An endeavor to understand a domain like AI art requires a sound comprehension of three basic things about the said field- the source or the cause, the process and the result or the product. Here, the source is AI, its genesis and further development to reach the feat of art; the process involves the computational and algorithmic underpinnings which include the computational models and programs, and the result which is associated with the AI generated art product in terms of its evaluation.

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2. Tracing the Roots: What is *AI*?

The vision of artificially intelligent systems started with a question raised by English mathematician, Alan Turing- "Can Machines Think?" (Turing, 1950, 433). An answer to such a question would have required understanding and thereby defining the terms machine and thinking, and for Turing, reaching such definitions was not only difficult but "absurd". To overcome this problem and to envisage a solution, Turing suggested another empirical method which he called as The Imitation Game. This adaptation of a Victorian style game basically involves three people, a woman, a man and an interrogator. The basic task of the interrogator is to guess which of the other two is a man and which is woman, based on asking questions and the replies to those questions. The role of the man is to trick the interrogator and that of the woman is to help him. For the purpose of the present question, Turing replaces the man with a machine capable of producing the same responses. He then asks a question, "Will the interrogator decide wrongly as often when the game is played like this as he does when the game is played between a man and a woman?" What if the machine tricks the interrogator into believing that it was human? If it successfully does so, the machine is said to have passed what has since then been famously referred to as the Turing Test. Based on this, Turing claimed that if an observer fails to distinguish between the responses of a machine and a human, the machine is said to be working much the same way as humans, that is, it also thinks.

While Turing was the forerunner towards development of this idea, it was John McCarthy who coined the term "Artificial Intelligence". Referred to as the Father of modern AI, McCarthy describes it as, "the science and engineering of making intelligent machines, especially intelligent computer programs." (McCarthy, 2012)). For him too, much like Turing, intelligence does not have a strict definition but varying degrees and kinds are observed (though he still believed it to be computable) and machine intelligence could reach to some degrees while cannot to some others. With time, AI has been understood variously as, machines with minds (Haugeland, 1985), making computer do things where

humans are better (Rich and Knight, 1991), studying the design of agents that are intelligent (Poole et al. 1998) or simply making the machine indulge in things that would otherwise require human intelligence (Minsky, 1968).

3. Stepping towards future: Concept of Technological Singularity

Over the years, AI has successfully covered many vantage points of human intelligence which includes natural language processing including translation from natural to machine language and vice versa, reasoning and problem- solving, decision making and similar others. These are some of the basic aspects of human intelligence and for AI thus, to prove its potential, successfully replicating these was the first step towards establishing itself. With every aspect that it was covering, both its appeal and quest to cover more was increasing. It still stands to debate as to whether all what AI has achieved is really credible, and optimists for AI however, are of the view that a state of *singularity* is not far. Kurzweil, in his book, *Singularity is Near: When Humans Transcend Biology*, discusses this optimism on how developments in AI will affect our life, "including death itself". Calling it as "a destiny we have come to", he describes singularity as,

> […] a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed. (Kurzweil, 2005, 24)

For Kurzweil, this *paradigm shift* will enable humans to transcend the limits of biological body and together with technology (AI), form a world where the line between physical and virtual is blurred and what will remain truly "human" is our pursuit to go beyond the limits of what our biological construction has to offer.

4. Towards AI Art: ANN, GAN and AICAN

With notions of technological singularity proliferating and advancing in discussions of AI, attempts were made by AI researchers to aim at certain aspects of human intelligence that were still comparatively untouched. One such attempt was in the

field of art. This new development in the field of AI has been termed as AI art. From the word itself, which sounds more paradoxical than sensual, AI art is a comparatively contemporary venture and a sub-field within the domain of AI. Loosely understood as algorithm art, code art or procedural art, this kind of art making is essentially set up on certain algorithms which is laid out to the computer in the form codes.* While explaining this, it is essential to keep in mind that art and likewise the term artist are rather "suitcase" words wherein it is possible for them to mean a lot of different things.

This technique of art making can include art ranging from visual-paintings, sculptures to audio and all other forms of art that are mechanically possible. The first such instance of art comes from a computer program by the name AARON that in collaboration with the painter Harold Cohen in 1973 produced a series of paintings. From then onwards amidst an AI "winter break" for a few years, there has been a consistent development in this field thanks to the growing interest of the curious world.

4.1 Artificial Neural Network

Reaching the feat of present day, AI art was a product of years of development in computer networking and coding. Artificial neural network (abbreviated and henceforth, ANN) was the stimulus in AI that opened up various frontiers including art making. This kind of networking which is inspired roughly by the human biological brain, works with various layers of networks which passes on signals received as input through serial transmission- to produce an apt output. To break it down, while the word "neural" (in ANN) signifies a thing that holds a number, which in biological case is a neuron; the word "network" stands for connections. It is much like our biological brain but only, artificial. An ANN basically consists of a network of layers where there is signal transmission happening among different layers- namely the input layer, hidden layers (multiple) and an output layer. The transmission of signal happens at terminal points or nodes that are present in each layer. More the number of layers, deeper the network will be and consequently more intense the processing.

What is fascinating about these ANNs is the way it processes data. To take an example, in image procession if the network has to identify a dog, then to enable the processing it will be fed with numerous images containing different types of dogs and those images that are bereft of dogs. The network will then be trained likewise about the shape a dog has or its other peculiar features. Then, the network will employ its own mechanisms that require complex computational mechanisms to finally identify dogs from non-dogs. There is hence, a kind of training that is imparted to the machine containing such a network, while not actually feeding the exact algorithms. The machine as a result learns, rather than mere programmer given- algorithm to output- generation. After repeated exposure and some amount of training, the machine actually works on its own, developing its algorithm *suo moto*.

In essence accordingly, the machine does not remain completely human programmed. This sort of processing is relatively different from its earlier traditional counterparts where the machines had to be specifically guided with point specific algorithms in order for it to carry out the computation. ANN is useful mainly for complex problem solving and computation which is non-linear and interpretative (that is non- evident), much like human intelligence which functions in a complex environment involving netted ideas and often deciphering unseen (not directly given to perception) relationships.

4.2 Generative Adversarial Network or GAN

A subsequent development in ANN has been that of Generative Adversarial Networks or (and henceforth) GAN. It is basically a specialized form of ANN which has three components- generator, adversary or a discriminator and a network linking the process. Developed by Goodfellow et al. (2014) it sought to overcome problems associated with traditional ANN. While it offered complex processing, ANN lacked accuracy since it was prone to over fitting that is, relying too much on training data points that may be not be accurate representation of the whole input domain.

GAN attempts to solve this problem by distinguishing the fake from real by employing two neural networks- a generator and a discriminator. This process involves complex computation and

programming mechanisms working basically on the two neural sub-models (generator and discriminator). The generator network is responsible for producing new samples based on the input domain data with an attempt to create fake outputs as close as possible to the original. The discriminator then attempts to differentiate the original from the fake, working in competition with the generator. This practice proceeds with multiple such operations, where both the models try to better their particular tasks thereby training the whole network and producing relevant outputs.

GAN finds peculiar importance in the domain of modern AI art. In this type of unsupervised learning which is in,

> contrast to traditional algorithmic art, in which the artist had to write detailed code that already specified the rules for the desired aesthetics, the [...] algorithms are set up by the artists to "learn" the aesthetics by looking at many images using machine learning technology. The algorithm only then generates new images that follow the aesthetics it has learned. (Elgammal and Mazzone, 2019, 26)

Elgammal discusses that there are basically three stages in this art creation process, namely, pre-curation, tweaking and post-curation. In the pre-curation stage, the programmer or human artist provides collection of images as input to the computer. In the second stage, images as inputs are tweaked or fed to the GAN which processes the inputs and gives output(s) as a set of images. In the post-curation stage, the artist finalizes the images he wants and curates them into a collection. It is however important, as Elgammal points out, that here AI is used merely as a tool and most of the work is done by the artist. It would be wrong thus, to call the AI as the artist since it is merely "generating" a set of images, whereas, the pre-curation, tweaking and post-curation work is actually the task of the human artist. Nevertheless, it is essential to acknowledge the system's ability to come up with images which potentially contain the "artistic" credence which means that the machine is in some sense having the idea of the necessary requirements that can yield into an artistic product. And it is also important to keep in mind

that it is from these generated images that the final sets of images are chosen. GAN, seen in this light, is not only working merely as a tool but also a collaborator in the art making process, transcending the boundaries of only an assistant or helper.

4.3 From Generation to Creation: AICAN

As pointed above, AI through ANN and GAN mechanism was working as a tool or a collaborator for art generation lacking its self-ability to create art, that is, the requirement of human artist was not just essential but also the main force to the art generation process. Eyeing this issue, and understanding art "from a perceptual and cognitive point of view", researchers developed the "Creative Adversarial Network" or AICAN (Elgammal et al. 2017). Based on Colin Martindale's theory of art, according to which, an artist after being exposed to a corpus of artwork, at a certain point of time, breaks out of certain set patterns of art making and develops newer, fresher styles (Martindale 1990); this new network allows computers to self assess the fed artwork, learn from those and develop new art pieces.

Explicating the mechanism behind this exercise, Elgammal and Mazzone stipulate,

> The machine is trained between two opposing forces—one that urges the machine to follow the aesthetics of the art it is shown (minimizing deviation from art distribution), while the other force penalizes the machine if it emulates an already established style (maximizing style ambiguity). (Elgammal and Mazzone, 2019, 26)

The writers argue that this process is more than mere generation or tool assistance because here it is the machine itself which is working with a much larger set of images as input (not necessarily a curated set as GAN) and learning itself to produce works that are not only novel but also innovative and surprising. This stylistic ambiguity ensures that there is not just novelty in artwork (creativity) but the other aspect ensures that it is not just anything novel, that is, it follows a certain boundary of art standards (family resemblances). When this process fructifies, a potentially self-efficient AI that "creates" art can be viewed as forthcoming.

5. AI art and Evaluation

As seen above, models of GAN and AICAN are major steps in the field of AI art that provide stimulus to future developments. No doubt, for any field to take shape, giving it a proper structure is not only important but an essential pre-condition. These models provide just that needed structure to the domain of AI art. However, for a holistic build-out other aspects should also be taken into consideration. Apart from modelling, art evaluation is something which to central to any enquiry about art. Evaluation is essential for art because goodness-badness constitute a primary aspect of art products (Gordon, 1952); art without evaluation would essentially mean stagnation since there would be no further growth of the artist, and man being a social animal, growth is always seen in relative. In that sense, evaluation serves two-fold purpose- first, it engages the audience with the art thereby opening up varied interpretations and initiates learning both for the art and from the art (Rekha and O'Neal, 2018) and second, for the artist, it assesses whether the intention behind the art has been communicated and also provides impetus for further development.

5.1 Aesthetics and Art Evaluation

While art evaluation is mostly based on value- instrumental or intrinsic, it has been often synonymously interchanged with aesthetics, such that value of art is aesthetic value and art appreciation is aesthetic appreciation (Aldrich 1963; Beardsley 1981). It is in some way justified to make such a claim because aesthetics and art are intricately related, for the former "examines the nature of art and the character of our experience of art". (Audi, 1999, 11-12). The term, aesthetics, in its modern orientation, that is, in close relation to art and as a separate philosophical domain, was coined by Baumgarten (1954), where he correlated it with sensory experience and feeling as opposed to knowing. Later, the term gained prominence under Kant† where he understood it as subjective experience dependent on inciting pleasure. This experience arises from an object, for instance artwork, in the aesthetic recipient or the evaluator/appreciator who in turn initiates art evaluation in terms of interpretation, decipherment and eventual aesthetic judgement or art appreciation. It is however important, to note that aesthetics is a broader field of study than

just philosophy of art because it corresponds to all such experiences that are somewhat related to beauty and taste which may exist even outside the domain of art.

Just like art is an open concept, aesthetics as a domain, has been exposed to varied interpretations and what exactly comprises of aesthetics per se is still a contested concept. Firstly, the concepts integral to aesthetics are themselves vague and too broad to be aptly defined. Any discussion on aesthetics will involve considerations on topics like art, beauty, good, experience, judgements and similar others, all of which have varied interpretations and connotations associated with them. Secondly, there is a problem of "interrelated characterizations of the nature of art, the nature of aesthetic properties, and the nature of aesthetic experience." (Lavinson, 2003, 7) This interconnectedness adds complexity to large corpus of theory and content, which makes the field a difficult pursuit both in terms of understanding and explication. This being the case, however, evaluation of art or aesthetics, is still possible and serves an essential hallmark for categorizing good from bad art.

5.2 Aesthetics of AI art

With the passage of time and developments in the field of AI, there has been increasing acceptance towards AI generated paintings, music, poetry and the like. An underlying idea to this acceptance, as Chamberlain et al. writes,

> […] is the extent to which individuals are willing to accept computer art as having the same worth and aesthetic value as that of a human artist, regardless of whether it passes such (like Lovelace)‡ stringent tests of human-level intelligence. (Chamberlain et al., 2018, 178)

However, as much as there is acceptance, a large proportion of human observers still hold a bias against AI art. A study was done by Kirk et al. (2008) where images presented to the observers were labelled either as coming from Louisiana Museum of Modern Art or computer generated (through usage of Photoshop). Even though being identical, images from art gallery were deemed more aesthetically pleasing over the computer-generated images. Another study done by Elgammal et al. (2017) of the Art and

Artificial Intelligence Lab at Rutgers University, "to test whether human subjects would be able to distinguish whether the art is generated by a human artist or by a computer system, as well as to rate aspects of that art" (Elgammal et al., 2017, 13) found that humans showed a preference towards computer generated art as compared to human generated and even considered the former as "visually structured, communicative, and inspiring". (Elgammal et al., 2017, 18) What was surprising more was the fact that around 75% of the time, observers thought that images from computer were actually a human artists' creation.

A similar study done by Chamberlain et al. (2015), found that there was "No significant difference in aesthetic rating between man-made and computer-generated images for ground-truth categories" (Chamberlain et al., 2015, 112). Another research by Chamberlain et al. (2017) about the behaviour humans have towards non-human artists with respect to certain visual art pieces found that while humans failed to discern between human and non-human made art (thereby making the AI machines pass the Turing Test), they nevertheless held biases against machine made art when told about the identity of the author. Moreover, Hong and Curan (2019) in an examination of aesthetic responses discovered that more than the quality of the artwork it was the external aspects like bias and expectation that influenced the human evaluation of art.

There are two conclusions that can be drawn from above mentioned studies. Firstly, although it is art evaluation, the source of art product or the artist is affecting the aesthetic responses and secondly, that AI art does have the potential of aesthetic appraisal and at times fares better than humans. Turning to the first conclusion, of the negative bias towards AI art, it can be viewed as arising primarily from the importance given to embodiment in art. This idea of embodiment is often taken as an important aspect of aesthetic judgement (Freedberg&Gallese, 2007). The basic presumption to this basis arises from the belief that only a specific type of personification can make a genuine artwork. The idea behind this notion rests on three important aspects- that art has certain essential properties; these essentialities can be depicted and produced in art only by specific creators and that these creators only can be termed as "artists" and their work as art. This however,

contradicts notions about art. Art is an open concept and does not have essentialities. What makes something art, is its "family resemblances" to other acknowledged legitimate pieces of artwork. The embodiment presumption in judgements therefore rests on flawed beliefs and does not represent accurate judgements. The negative bias for AI art thus needs to be rethought and eliminated with aesthetic evaluation s made on neutral grounds sans biases.

As far as second conclusion is concerned, it makes a rather important claim not just about AI art in particular but art in general. What the unlabelled, uncategorized studies on human observers about art brought to light is the idea that embodiment is not an aspect that naturally comes while judging art but its addition does influence the feedback. AI art therefore, is not a disjoint in the art set. It can very well be taken a potential entity for art appraisal and its lack of human embodiment does not necessarily negate its aesthetics. Whether or not it is good art is something that requires evaluation but its categorization as art- good or bad should not be questioned. Another important sub-part of the conclusion is how AI art fared better in terms of qualitative judgements as compared to human art. The question then is- what is it about unlabelled AI art which makes it fare better in contrast to human made art?

5.3 AI and Effective Art Making

An important result of various studies conducted on art, point towards an important observation- AI art had more suitors than human art. This observation challenges many convictions about art, primarily against those which consider art as an essentially human exercise. If AI art is largely discredited when labelled so, what makes it shine better against human made art when the labelling is absent? Answering this question would require comprehending what makes AI art have more aesthetic worthiness and competence which its human counterpart seems to be lacking behind at.

Indurkhya(1997) points out two classes of mechanisms that are predominant in effective cognitive creative mechanisms. These two mechanisms as he points out are deconceptualization and juxtaposition of dissimilar. An analysis of these mechanisms with respect to both computers and humans depicts the notion that it is

much easier for computers to excel and carry out better, these two processes, in contrast to humans because and as Indurkhya concludes "we are constrained by the associations of our concept networks that we inherit and learn in our lifetime" (Indurkhya, 1997, 7)

5.3.1 Deconceptualization

Deconceptualization stands for transcending or going beyond the arena of accepted beliefs, ideas, theories and parameters. In this process we tend to flush away those concepts that we are either born with or are forced from the society. Indurkhya, in his paper 'Computers and Creativity' counts the process of deconceptualization as an essential aspect of creativity. And since art is a part of creative exercise, deconceptualization also partakes in art. We sometimes encounter deconceptualized frameworks that are a distanced from the accepted norms in society. Depiction of common and consented ideas will not have the newness and originality that is expected of artworks. The element of surprise and the "wow" factor, if we may call it, would be missing from such productions. This idea of deconceptualization has been lucidly explained by Rodari in his book The Grammar of Fantasy: An introduction to the art of inventing stories as a three-step process:

a) *Estrangement*: this involves the idea of enunciating a thing as if it was encountered for the first time.

b) *Association*: forming new interpretations and meanings by connecting and linking different ideas and then forming images from the same

c) *Metaphor*: metaphor formation with the images formed in the previous step.

Deconceptualization also involves moving away from commonalities and similarities. Detachment from the limitations in the concepts, giving up the accepted conceptual baggage thereby opening up new frontiers for creative art comes from this very process. This process can also be seen as similar to what Husserl has termed as epoche. The term stands for the suspension of what is called as the natural attitude which is the commonsensical stand that most of us have towards the world around us. It is depictive of

the habitual and regular that prevents originality, newness and developing fresher perspectives and interpretation; thereby making us ordinary. The attitude of epoche, on the other hand, demands a rejection of normal and prevalent and acceptance of extraordinaire and uncommon.

As stated before, deconceptualization forms an important part of the art making exercise. However, this is a difficult exercise for humans primarily because we are so much trapped in our accepted norms and notions that it is a tedious task to look beyond that. Had it been a simple enterprise, all of us would have been artists of sorts. We are so intricately tied up in the web of our conceptual baggage that fresh thinking is a tough endeavour. Suspension of judgment which is made on established and well accustomed notions will be challenging, if not impossible.

On the other hand, computing machines are in a much better position compared to humans. Having no familiar or familial ties, these machines naturally are agnostic towards everything at first. All data is new data and every process is a new process. Every single stimulus is taken one at a time without looking at it with a pre-established notion or concept. Removing or detaching from already coded concepts is also much easier for these machines compared to their human counterparts. This less "humanness" allows for a swift deconceptualization mechanism in these machines. Building new concepts and new ideas, therefore, becomes an easy task for these systems. Flushing out past concepts is easier, because for them, to begin with, the judgment does not function like humans, and secondly because they can have easy modifications in their working with a slight alteration in their algorithms. With this ability, which is a demarking feature of art making, it becomes more probable for computers to depict their artistic abilities.

5.3.2 Juxtaposition of dissimilar

Combination of unrelated ideas and diverging perspectives to create novel combinations is understood as the process of juxtaposition of dissimilar. The prime idea behind this process is to keep at juxtaposition, dissimilar objects and create novel meanings

by combining these dissimilar. Also understood as lateral thinking (Bono, 1975) which means "new ways of looking at things and new ideas of every sort" and exploring "all the different ways of looking at something, rather than accepting the most promising and proceeding from that" and as displacement of objects (Schon, 1967) which involves conceptual reframing by bringing the familiar into the realm of unfamiliar thereby creating newer concepts while at the same time retaining as much as possible of the old; this process also finds mention by Indurkhya as a peculiar aspect of creativity. And assuming all art to be in some sense a creative enterprise, this feature also becomes important for art making.

Juxtaposition of dissimilar is for that reason helpful in artistry and magnifies the strength of the creative process involved. In this process there is a demand from us to enable a reconsideration of ideas which yields to novelty while discovering meaningful and appropriate matches and connections. The familiar or similar is kept at bay. Dylan Thomas, a famous painter, accepted the fact that he had employed a similar process during his poetry composition. Salvador Dali's Lobster Telephone is a result of association between unfamiliar objects- a lobster and a telephone- something that conventional companionship will not yield to. Even outside of art, in scientific innovations, such dissimilar associations are common and have resulted in ground breaking creations. Graham Bell, for instance, conceived telephone by comparing working of the ear with membrane movement to move steel; Philo Farnsworth created television due to his farming interest; Louis Braille, blind since childhood, developed the Braille script by getting inspiration from the touch and feel of different spears.

Though this process has been implemented by many artists in varying art forms, it still remains a tough task for most humans. The reason for this difficulty is that we are all so much trapped in our worldly connections and associations that to break off from them and think in newer ways becomes all the more challenging. Our cognitive functions work largely based on our practices and concepts that are familiar and come naturally to us. It is because of this, that our everyday exercises are mostly similar and conventional, lacking freshness. Identifying the dissimilar and then juxtaposing them turns out to be a tedious if not an impossible task

for humans. And it is because of this embeddedness in conventional thinking that artistic masterpieces take so much time and effort. The idea that is put behind such striking art pieces requires in general, immense deliberation. Conventional thinking leaves little room for creative art. It turns out therefore, that prima facie for humans, juxtaposition of dissimilar will be a tough task at hand because of our societal, cultural and educational situatedness.

Computing machines, on the other hand, seem pre-disposed with such an ability. They are not necessarily tied within the web of ideas and concepts like humans that yield to familiar associations. It is easier for them to think about unthinkable associations that we as humans would face difficulty making. In computer processing, the mechanism is not guided by such filtered approach of working within the accepted similarities and familiarities like humans, because of the absence of cognitive thinking based on cultural, societal norms that we are exposed to from the beginning, in virtue of our being human. Everything at first is taken to be new or unfamiliar and processing starts with respect to the input and initial code which could be based on completely new even antithetical and off beat nature. No pre-established notions are associated with any object or idea if not warranted. An image of a dog as an input will be taken by the computer as any other image unless the algorithm defines that the input image is of a dog with such and such characteristics. For humans, on the other hand, a mere mention of the word dog engenders a picture of an animal with four limbs, a wagging tail and barking. Computing machines, would not envisage such a picture unless sanctioned by the initiatory code. It is as much empty and similar to any other input unless the programming specifies what it is. The programmer has to clearly specify what that image corresponds to for the computer to generate a picture similar to what humans traditionally associate it with.

6. Conclusion

Being better at these mechanisms of deconceptualization and dissimilar juxtaposition, computers can create better and more creative artworks than what humans can. Although, this claim does not necessarily entail that all AI art is better than human art, it

showcases computers' potential to be a notch ahead of humans. And it is as a result of such potential that AI art may create outputs which are appraised and appreciated more when put before appropriate observers (as the various studies have concluded). It is also important to keep note of the possibility that because of lack of such conceptual ideas and associations, AI art is more likely to beget outcomes that are nonsensical and absurd and end of up depicting no art at all. What this points to is the idea that while deconceptualization and associating dissimilar are stimulus to artistic enterprise, some sense should come of the product, because otherwise there would be no boundary between genuine art and nonsensical creations. There are limitations and challenges in every field and subsequent developments work precisely on filling these loopholes. Holding biases and rejecting an area altogether reflects an un-accepting and egoist attitude. In the end, it can be pointed out that artistic creativity of AI is still in early stages and advancements in the field have been undertaken since a comparatively shorter time, especially with respect to how much time humans have been around making and learning art. The machines, in a relatively shorter span of time, have shown much credence and worth, and hence, deserve appraisal and motivation much more than disavowal and criticism. To conclude, a child who returns home with a self-drawn painting of something really simple and trivial (often artistically unworthy) does not get compared to the likes of Picasso and Leonardo Vinci but rather receives encouragement, why can we not, envisage a similar outlook towards the machines?

Endnotes

* The difference between codes and algorithm is that while the latter is a finite set of calculations or instructions which will yield an output provided a certain input; the former- code- is the implementation of those algorithms via a computer on the basis of certain programming languages.

† Kant, 1914.

‡ Added words

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