Looking for technosignatures using the brain and Artificial Intelligence

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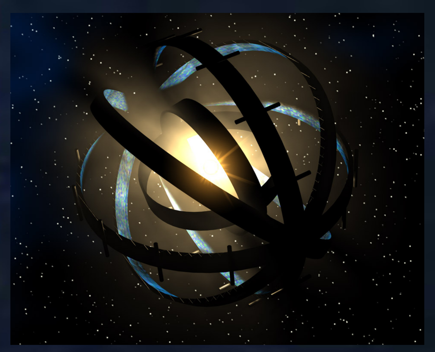
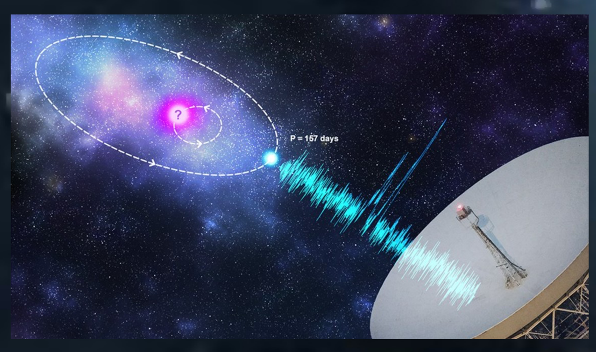
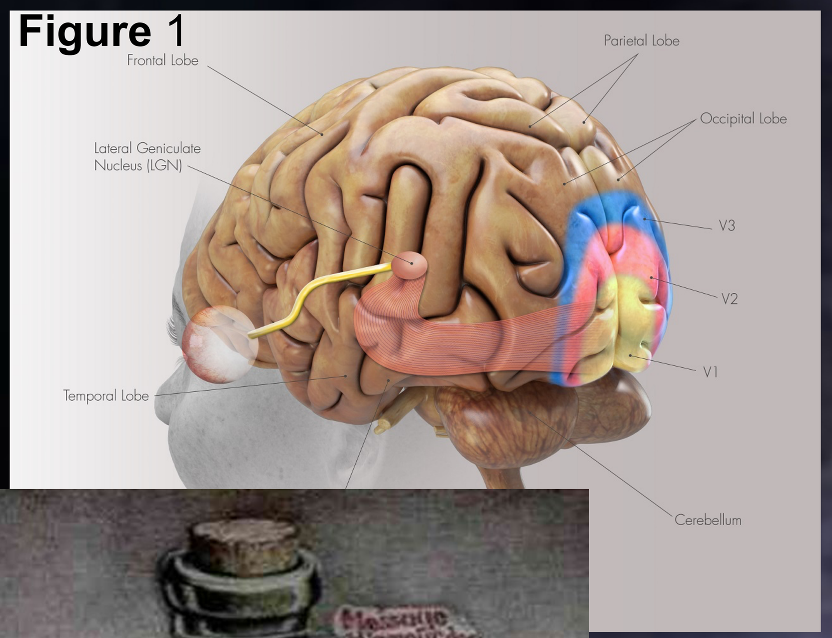
Introduction





Technosignatures involves the detection of radio signals, lasers, atmospheric pollution, radiation leakage from megastructures or sidereal installations such as Dyson spheres, Shkadov thrusters with the power to alter the orbits of stars around the Galactic Centre, etc. Some authors have postulated the possibility of previous ancient civilisations indigenous to our solar system having left behind some techno-signatures that we might find. However, if we look for these techno-signatures, artificial structures or signs, our minds can easily become confused when confronted with the unexpected. In recent times we had news about several events that made us question its possible extraterrestrial intelligent origin: The Tabby star anomaly, Oumuamua object and the 16 days periodic radio patterns detected by CHIME/FRB. Facts open to interpretation, our brain interpretation (Fig. 1). The question is whether our minds are ready and capable of finding and understanding such techno-signatures, or whether we need to wait for our consciousness to be able to apprehend and comprehend these phenomena. Children can only see dolphin in figure 2. Could we get some help from artificial intelligence (AI)?

Figure 1



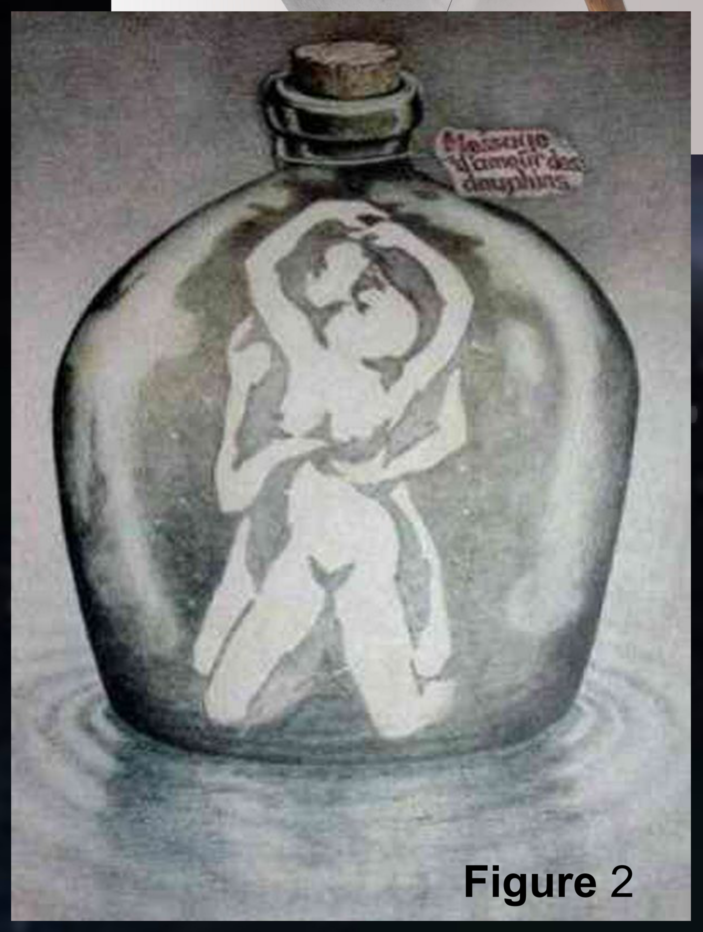


Figure 2

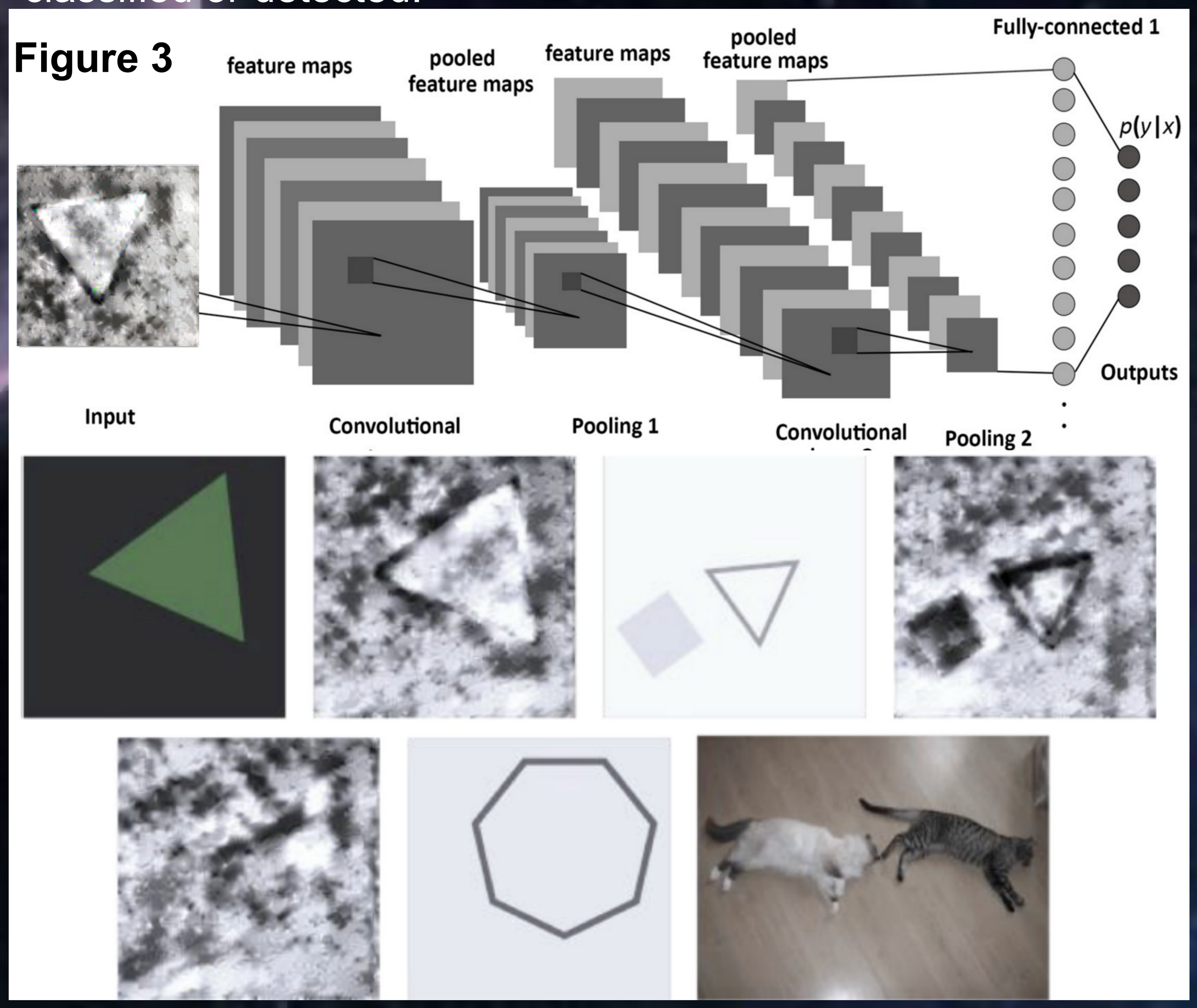
Participants

We recruited a sample of 163 participants. All participants were older adults, 40 men and 123 women with a mean age of 22.29 years (SD 3.48), and all were volunteers. None of them had training in astronomy, a related specialty or expert satellite imagery analysis

Methods

A comparative visual perception and pattern recognition experiment was performed by humans and by an AI convolutional neural network (CNN) model of computer vision. For the experiment we used a section of the NASA Dawn probe image PIA21925 (Figure 4), specifically a section from the Vinalia Faculae (VF-1) region in Ceres's Occator crater, i.e. part of the popular bright spots. The computer vision model used to analyse the image was an AI model based on Convolutional Neural Networks (CNNs) (Figure 3), a type of computer vision model based on deep learning. CNNs are a category of neural networks that have been successful in areas such as image recognition and classification. Some examples of their application include the recognition of faces, objects and traffic lights. In addition, they have revolutionised robotic vision systems and autonomous vehicles. CNNs have to be trained in order to equip them with adaptation skills. During training, the CNN learns by using a set of representative images that depict the different objects to be classified or detected.

Figure 3



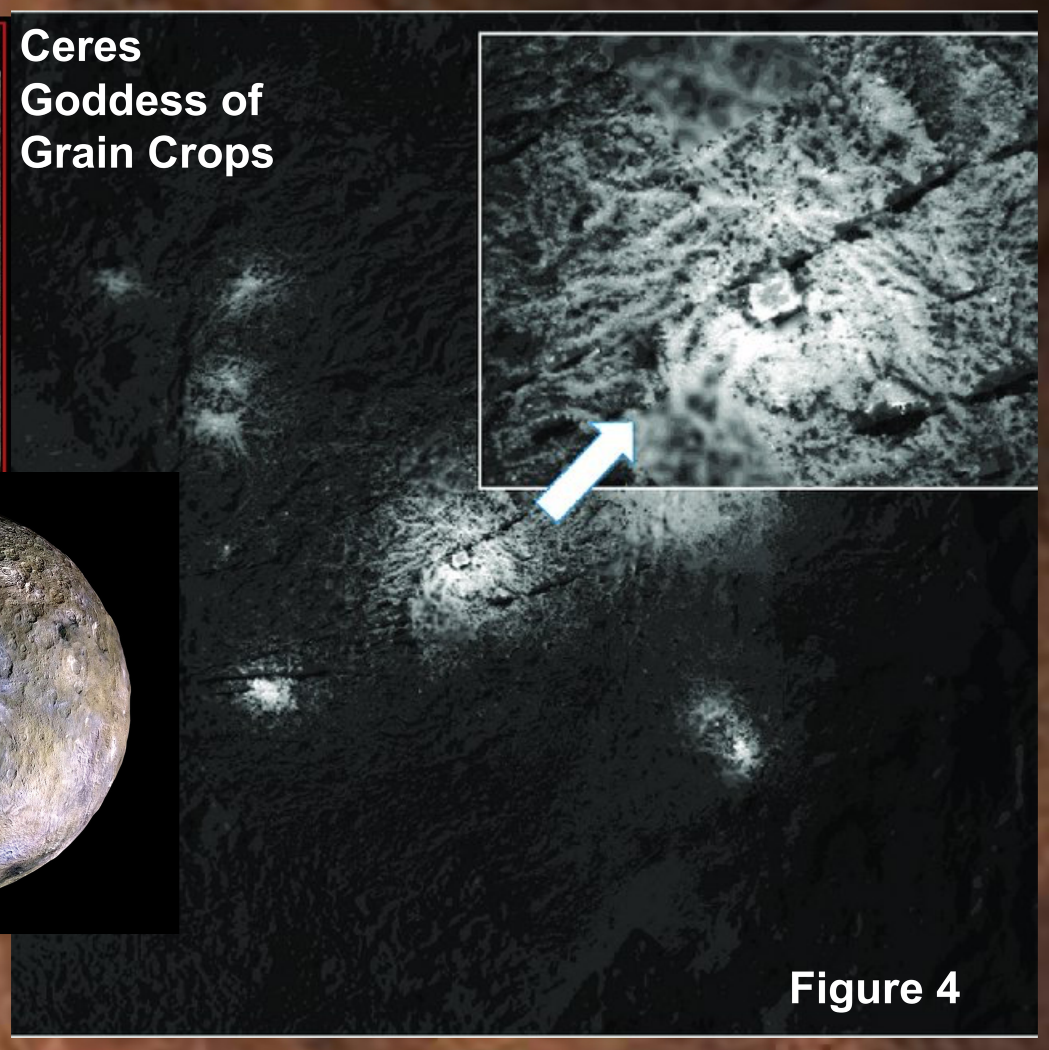


Figure 4

Results

Feature 1 (Figure 5) was the pattern most frequently recognised, as predicted, because it represented a well-defined rectangular area in which the space probe Dawn did not get the best resolution conforming to a rectangle section in the image. This pattern was considered our control stimulus because it was obviously artificial. It was followed in popularity by pattern 3, which was perceived to be a circle. Pattern 5 (the big, darker triangle) was the least often detected feature in the first instance. However, after participants performed the reconnaissance task, *a posteriori* when they were asked whether they could see a real triangle after it was traced, the percentage detecting it rose from 7.1% to 56%

Recognition	5A	5B	1	2	3	4
yes	11.00	63.20	85.30	47.20	66.90	36.20
no	89.00	36.80	14.70	52.80	33.10	63.80

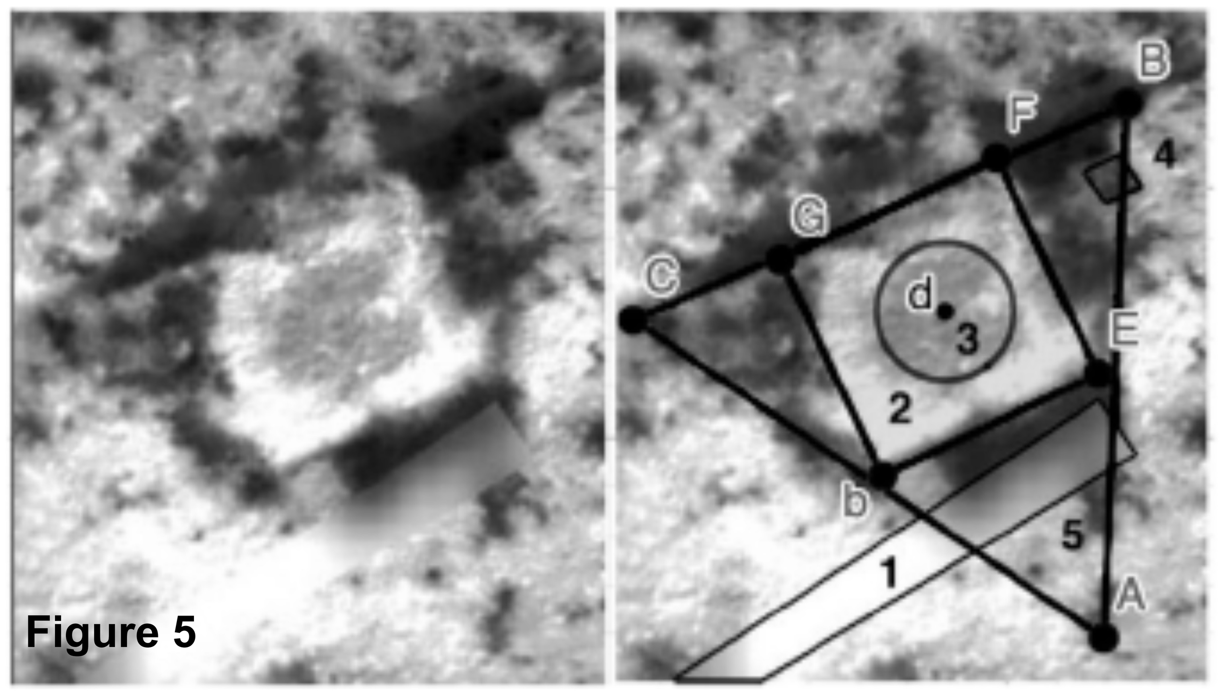
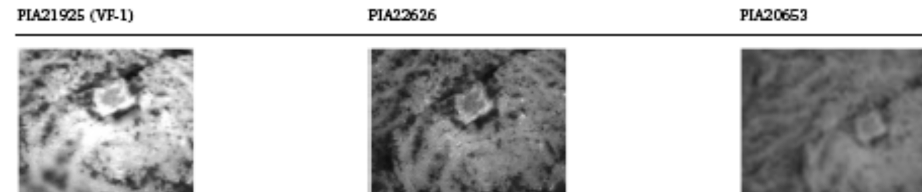


Figure 5

CNN AI computer vision model detection rate for the test image and two more of the same location at Vinalia Faculae, Occator crater, Ceres. Original image credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA/PSI.

Figure 6



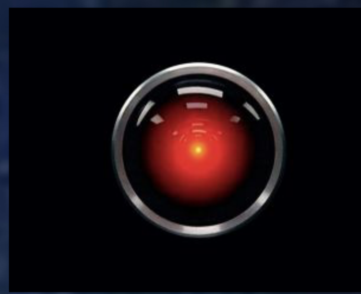
Date and altitude	PIA21925 (VF-1)		PIA22626		PIA20653	
	July 16th, 2018. 34 km		July 6th, 2018. 58 km		March 26th, 2018. 385 km	
	Triangle	Square	Triangle	Square	Triangle	Square
% detect	52.69	86.16	51.79	91.18	57.52	87.30

As for the CNN AI model, the results are strikingly similar to those obtained by the humans for the images of VF-1. However, the CNN AI model was also tested with two other Dawn images for contrast and observation of the model's performance. To our surprise, the model still detected both triangle and square formations or patterns on images PIA22626 at 58 km of altitude and PIA20653 at 385 km, both images having been obtained by Dawn at earlier stages of the Ceres exploration (Figure 6). There is a constant detection result for both triangular and square patterns. This confirms that the CNN computer vision AI model detected at least two patterns compatible with two different geometric forms (triangle and square) in the same formation in three different images of the same location at Vinalia Faculae, Occator crater, the bright region on Ceres.

Discussion and Conclusions

Two aspetcs to discuss in light of results: First, if we suppose that the *'Vinalia Faculae anomaly'(VF-1)* is just a perceptual anomaly, AI did not help to disclose its real nature. This may be a concern for the future use of AI model applications in the search for technosignatures, especially in computer vision analysis. Second, AI offered marginal positive detection (triangle), creating a hard to solve and accept cognitive dissonance for VF-1 and its possible artificiality.

When people perform a selective looking or searching task by devoting attention to some aspects while ignoring others, they often fail to notice unexpected information in front of them. This is called in cognitive psychology inattentional blindness. Could this happen to us while searching for technosignatures (the cosmic gorilla effect)? Will AI really help going beyond our limitations? Maybe we are just as the children that could only see dolphins in the jar. (Figure 2)



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