

“Hidden Incidents of Pet Food”: Portraying Taurine Deficiency in Cats

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Abstract

“Hidden Incidents of Pet Food” is a digital artwork that combines contemporary art, machine learning, and data storytelling. It aims to reveal a relatively unknown yet significant social issue, specifically the deficiency of taurine in cat food. Leveraging Artificial Intelligence, the authors generate digital portraits of 6,000 cats who died from this deficiency. Incorporating additional data from the documented history, the authors reveal the hidden incidents through visualization and data storytelling, showing the trending relationship between the boom of pet capital markets and the deaths of cats due to pet food problems. The AI-generated cat portraits and incident data go beyond the facts and could become a historical memorial for blind cats and those tragic fatalities linked to pet foods. Our computational approach reveals the questionable relationship between people and pets as controlled by capitalism.

Keywords

Pet Food, Contemporary Art, Machine Learning, Data Visualization, Resilient Storytelling, Taurine Deficiency

Introduction

Our research delves into the pervasive “race to the bottom” issues, a term coined by Louis Brandeis, that arise globally as a byproduct of the rapid development of capitalist society. These issues encompass a range of detrimental practices, including the production of unhealthy, inexpensive food, the use of toxic substitute ingredients, and the perpetration of environmental fraud and dumping for profit [1]. Such practices cause harm, either inadvertently or deliberately, to both humans and a variety of species. A focal point of our study is the under-acknowledged realm of pet food-related issues. Our work concentrates on taurine, an essential animal protein for cats that can only be obtained via food. For a long time, the public was unaware of its importance, and the lack of taurine in pet food will result in pets suffering from heart disease and blindness. In 1976, scientists first investigated and found the relationship between taurine deficiency and cat diseases [2], yet taurine effects in pet food remain unnoticed till now. Contrasting sharply with the ideal of harmonious co-existence between humans and companion animals, as Donna J. Haraway [3] discusses, the actual dynamics of human relationships with companion species are notably more complex

and multifaceted. These relationships often involve darker aspects, such as animal cruelty and intrinsically unequal coexistence. Beyond being mere companions, pets are increasingly viewed as central to highly commodified investments, deeply embedded within global economic disparities, a notion critically analyzed by Heidi J. Nast [4]. This complex interplay is further entwined with the growth of post-industrial service markets, where human affection for pets plays a significant role in driving economic trends. By examining taurine deficiency as a case study, we aim to unearth obscured stories and draw connections across the historical, current, and future landscape of pet food-related life issues. Our research and artistic endeavors aspire to narrate resilient stories that serve as a collective memory and highlight critical social issues. Our contributions include:

- Uncovering the taurine deficiency in pet food and revealing its resulting hidden incidents;
- Reconstructing the history using an AI model that transforms images of healthy cats to blind ones, mimicking the devastating consequences of eating taurine-deficient pet food (Figure 1). Using this model, we restore AI portraits of 6,000 cats passed away between 1976 and 1981 due to taurine deficiency;
- Making a data video using storytelling and data visualization techniques to relate the booming pet economy with hidden pet incidents.

Pet Economics and Pet Food

This section uses the development of pet food as a microcosm to illustrate the relationship between humans, pet economics, pets, and pet food in society (Figure 2). Scholars have argued that “the key moment in commodity culture is when a consumer good moves from the marketplace to a cultural ‘space’ marked by a relation of cultivation between the consumer and the object”. In this context, pets may represent the ultimate consumer good [5]. Discussing pets often revolves around themes of dominance, affection, and emotional bonding [6]. Consequently, pets are perceived as complex entities in our society, linked to post-industrial forms of hyper-commodification and alienation [7]. The rise of the pet economy is closely related to the rise of post-industrial spaces and intensified consumption [7].

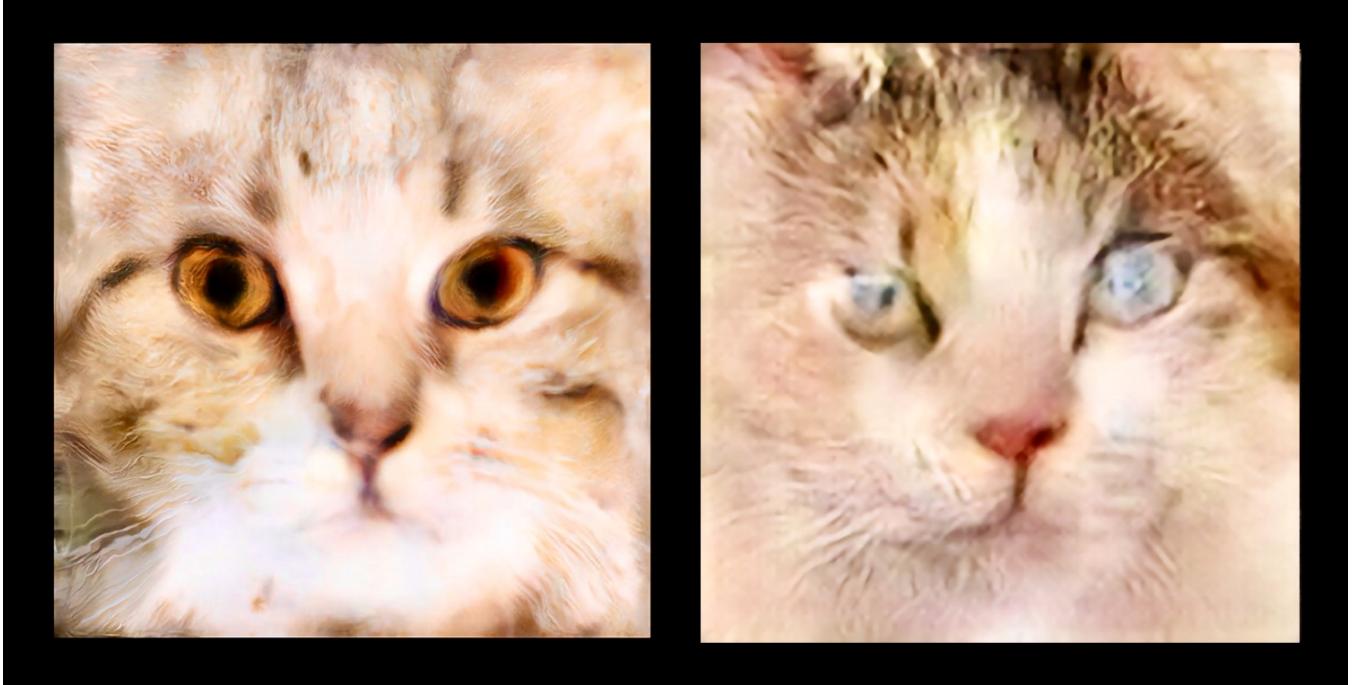


Figure 1: A healthy normal cat (left) transformed into a blind one (right) using an AI model. ©Ziwei Wu and Xiaofu Jin.

Heidi J. Nast says, “In post-industrial, post-modern worlds of pastiche, pet animals allure in part because they can be anything and anyone you want them to be [7]”. This versatility allows humans to project a range of customized emotional responses onto their pets, engaging in activities such as dog dancing, dog yoga, dressing pets in pet clothing, and even participating in sexual fetishes involving furry pets.

Although the background of pet economics applies to the world at large, our work primarily focuses on incidents that occurred in the United States in the 1970s-80s, when the research and data about pet incidents were relatively richer. The following subsection discusses the relationship between humans and pets in that era in the United States context.

Human and Pet: A Historical Perspective

“A pet in every home” is a business motto announced by the trade magazine *Pet Dealer* in 1929 [5]. This new business promotion approach involves various types of pets, such as cage birds, aquarium fish, puppies, cats, and so on, with the aim of changing people’s mindset of these animals from objects to subjects, from consumer goods to family members [5]. For a long time, the pet business tailors primarily to the middle class and above, with sales peaking around Christmas, especially as gifts for women and children.

Starting from the 1970s, the United States steps into a post-industrial society, where the service sector has grown and generated even more wealth than the manufacturing sector [8]. A symbol of this transformation is the peak of steel production in 1973, which eventually collapses in 1984. During this period, “the emergence of pets in post-industrial contexts as highly commodified and valued objects of affection

and love in the 1980s and especially in the 1990s helps explain why science has begun of late to study pets [7]”.

Another significant phenomenon in this period is the emergence of cheap food. The development of cheap food is a part of the capitalist process. In the United States, “the cheapest food in world history was realized after the crises of the 1970s. Cheap Food, in concert with strategies that re-stabilized energy, raw materials, and labor power, enabled the revival of accumulation that began in the early 1980s [9]”. The rapid development of pet food is related to the by-products of cheap food production.

Pet and Pet food

“Packing, canning, and processing plants further reduced the cost of calories through their relentless industrialization of American food [10]”. In this context, the first industrially produced pet food is born in the United States in 1922 [11]. Many companies also find it convenient and profitable to turn human food, especially by-products from grain milling, slaughterhouses, and commercial fisheries that humans do not eat, into animal feed [12]. Due to the emotional link between humans and pets, “the word ‘feed’ was never used for pet food; feed was for livestock, while food was for members of households [12]”.

Pet food is a commodity’s commodity. Lower-quality raw materials, exquisite packaging, and tendentious emotional marketing tactics create a new category of expensive, progressive, and fashionable product.

Selling the idea of packaged food for household animals and family members mainly focuses on three aspects: “appealing to pet owners’ emotions and pocketbooks, awareness of public interest in the developing science of nutrition, and

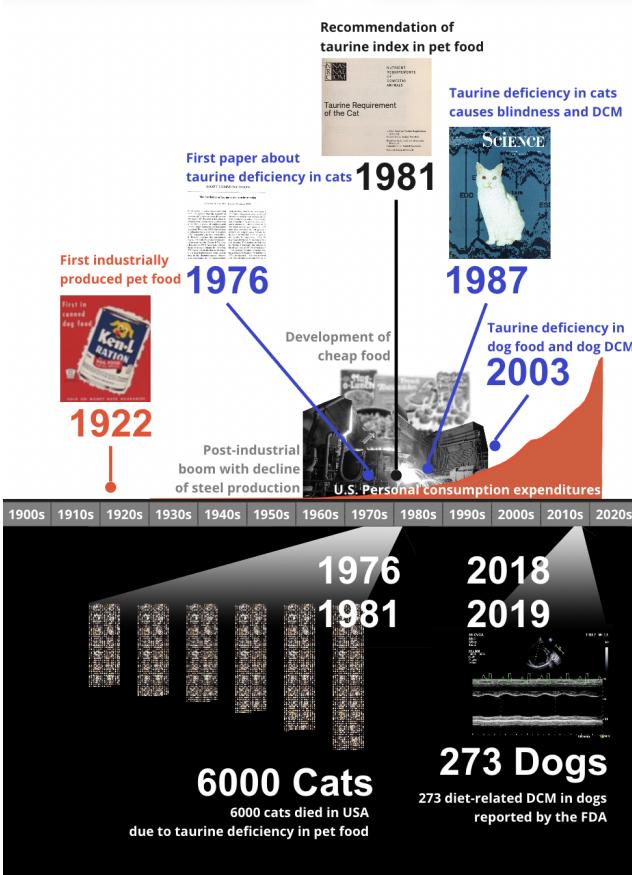


Figure 2: Historical timeline of related events, researches, and incidents in this paper ©Ziwei Wu, Ken-L Ration, Science, Chesapeake Veterinary Cardiology Associates, National Research Council.

women's interest in easing the burden of housework [12]". For example, several advertisements claims that "dog food purchasers, like people who bought canned soup or boxed crackers, were progressive consumers", "meat-fed dogs were less healthy, and commercial pet food was the true canine health food", and "marketing dog food is convenient, American housewives are free from homemade 'dog stews' and only need to pour out this granulated food" (Figure 3).

Related Work

Many contemporary artworks express social issues using different techniques. In this section, we discuss related artworks, including AI-generated artistic content and artworks with data.

Portraits and AI-Generated Portraits

Portraits are for memory [13]. Different portraits have different stories behind the image. National Portrait Gallery [14] presents people's life stories and portraits from the 16th Century to the present day. Jewish artist Christian Boltanski uses art to question and memorialize the darkness of the Holocaust in Second World War. History offers direct and indirect knowledge, which could be learned in a new form: dataset



Figure 3: Historical pet food advertisement on The Saturday Evening Post (26 February 1927) for the first brand of pet food "SPRATT'S" ©Image from the book "Pets in America: A history" [12]. Copyright reserved from SPRATT'S and The Saturday Evening Post.

for machine learning. *Memories of Passersby I* [15] by artist Mario Klingemann uses AI to generate an infinite stream of portraits by studying thousands of existing portraits during the 17th-19th centuries. In addition to human portraits, animal portraits have different characteristics, such as *Critically Extant* [16] by Entangled Others Studio, the majority of which are of endangered species and become increasingly essential social issues.

Artworks with Data

Data can offer a unique artistic way of expressing real-world stories and social issues with scientific facts and insights. For instance, *Invisible History* [17] by artist Donna Szoke discovers the astonishing fact that 270,000 radioactive mice are buried near Niagara Falls, NY, as a result of research for atomic weaponry. Szoke turns this invisible history into artwork through a mobile app [18]. *ReRemember* [19] by Changyoon Yi et al. is an interactive installation that uses biosignals data to remember and elicit strong emotions through pet owners and their deceased companion pets, offering a powerful tribute to these cherished relationships.

Unit visualization is one of the efficient representations that encodes data with intuitive visual marks [20]. For example, *The Fallen of World War II* [21] utilizes icons representing

different individuals to illustrate casualties caused by the Second World War.

Reflecting on the related work aforementioned, it's evident that numerous artworks explore memories within human society, as well as relationships between humans and non-humans. However, only a few artworks specifically delve into the human-pet relationships, which are important in daily life. For example, the strong emotional connection between companion species and humans often leads to spontaneous human tributes after the death of a pet, which has evolved into online tributes in recent years. This social background has partially inspired our work. The unique texture of images generated by AI inspires and attracts us, and we hope to use AI portraits to tell real stories. Combining real data with storytelling often uses calm and objective data to reflect shocking and touching facts. We aim to use this approach to reveal hidden stories of pet food that people may not be aware of.

“Hidden Incidents of Pet Food”

Using a collage art style and AI-generated cat portraits, combined with data visualization, we create a data video called “Hidden Incidents of Pet Food” to tell the story of taurine deficiency in pet food. The video showcases some of our research on pet food. This section describes the documented history of taurine deficiency in cats and introduces our AI generation method and data visualization method.

Taurine Deficiency in Cat

In 1987, researchers from the University of California, Davis published an article in *Science* on the relationship between taurine and feline diseases, stating that “feeding taurine-deficient diets to cats results in low concentrations of taurine in plasma and tissues, including the retina and myocardium. Taurine depletion for more than six months may produce feline central retinal degeneration (FCRD) and dilated cardiomyopathy (DCM)” (Figure 4). They also estimated that at least 1,000 cats die each year in the United States because of insufficient taurine in pet food [22].

As aforementioned, canned pet food began to be mass-produced in the United States in 1922, and since then, the number of cats and other pets that have perished is both unthinkable and untraceable. It was not until 1976 that research began to explore the relationship between taurine and retinal health in cats [2]. However, even with the emergence of relevant studies, there were no clear regulations regarding the taurine content in cat food in those days. In 1981, the National Research Council finally published their recommended level, stating that cat food should contain at least 500 parts per million of taurine [23]. Unfortunately, at that time, the taurine content in commercially available cat food was significantly below this recommended level. Moreover, due to the belated establishment of this recommended level, at least 6,000 cats died as a result of taurine deficiency during the six-year span without any related policy and regulation from 1976 to 1981, calculated according to the paper published in 1987 [24]. More disheartening is the fact that even after 1981, when regulations concerning the taurine content in cat food were widely publicized, it remains questionable whether the

relevant pet food manufacturers complied with the policy and whether any punitive measures were enforced against those who violated the regulations.

While we wish to trace back as early as possible, due to the lack of more reliable data and resources, we can only sample the known six-year span from 1976 to 1981, during which taurine deficiency causing cat deaths can be estimated. With this information, we then generate pictorial visual portraits to commemorate the innocent lives of cats lost during this period.

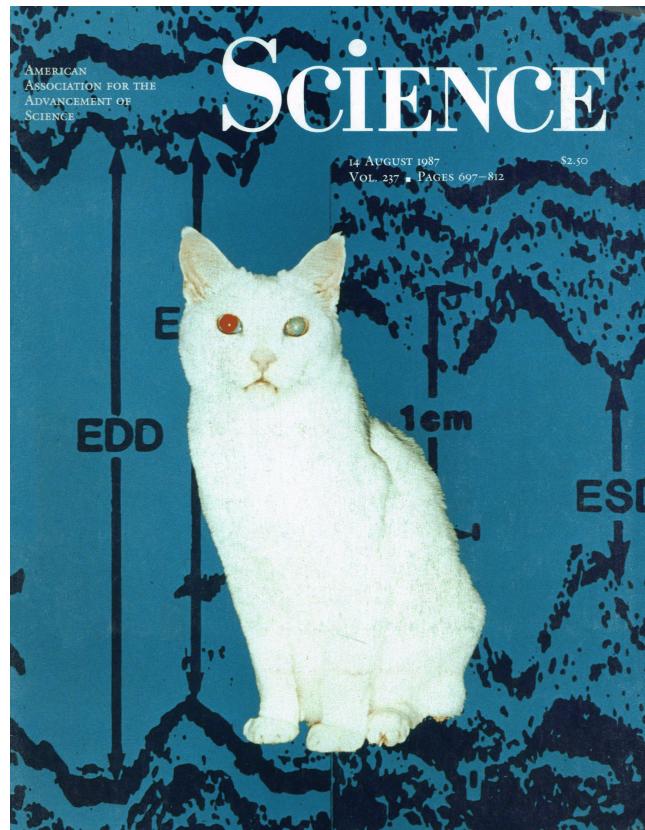


Figure 4: “‘El Blanco’ Glassauer died of dilated cardiomyopathy associated with taurine deficiency. His owner’s desire to prevent others from losing their pets stimulated work elucidating the cause and “cure” for feline dilated cardiomyopathy”. ©Photograph copyright of “El Blanco” by Cindy Glassauer. Image copyright of *Science* [25].

AI-Portrayed Blinded Cats

Public awareness of the social issue of taurine deficiency in cat food could be significantly raised by the artistic and visual presentation of affected cats, in particular, by the depressing images of their blinded portraits. We believe that presenting the process of turning a healthy and cute cat into a blind one could leave the audience with a deep impression. AI transformation model suits exactly this process by transforming a normal cat portrait to a blind one, presumably having eaten taurine-deficient food. We thus apply AI technology to mimic this process (Figure 1) and also restore the portraits of the

6,000 cats passed away between 1976 and 1981, part of them shown in Figure 6, based on the existing written descriptions combined with pictures of the relevant symptoms of the cats.

To provide the audience with a deep impression of the serious issue of taurine deficiency in cats, we wish to present virtual and interactive cat images reflecting the hurt caused by taurine deficiency. We use DCGAN (Deep Convolutional Generative Adversarial Network) to learn from the available real cat images. DCGAN is a generative adversarial network architecture that teaches a deep learning model to generate new data from that exact distribution of the training data [26]. In a DCGAN model, two parts are being trained via an adversarial approach; one is the generator, which learns to create images that look real, while the other is the discriminator, which learns to distinguish between real and faked images. The generator loss L_G is defined as:

$$L_G = -\frac{1}{2}E_{z \sim p_z(z)}[\log D(G(z))] \quad (1)$$

The discriminator loss L_D is defined as:

$$L_D = -\frac{1}{2}E_{x \sim p_{\text{data}}(x)}[\log D(x)] - \frac{1}{2}E_{z \sim p_z(z)}[\log(1 - D(G(z)))] \quad (2)$$

We first train a model using DCGAN with 10,000 normal cat images from the online dataset [27]. After the 1,000 epochs of training, we obtain a generator that could generate normal cat faces, as in Figure 5-A part. Second, we added the specific feature “blind” based on the normal cat generator. We then download images from search engines, including Google, Bing, Baidu, and Naver, with the search term “Blind Cat”. Next, we exploit the Haar feature to detect and crop the cat faces from the original blind cat images as shown in the left of Figure 5-B. Finally, we load the weights of the previously trained DCGAN model and fine-tuned it with these blind cat face images to obtain our final generator, as in the right of Figure 5-B. The output of the model—6,000 images of blind cats (part of them shown in Figure 6)—is sent to the next step for data visualization and storytelling.

Data Story on Pet Economics and Blinded Cats

We present 6,000 generated images of blind cats intuitively and interactively alongside pet economics data. This allows for a smooth incorporation of economic trends with individual pets.

Data Sources Our investigation focuses on two types of data: pet incidents and pet economics. It is hard to collect incident data directly related to taurine deficiency in cats. We attempt to obtain the data from the Food and Drug Administration (FDA) pet food recall records, as the FDA is the official government organization that is closely related to these incidents. However, no recall is found related to taurine deficiency, except for one investigation in 2018 [28]. Most incidents are hidden under the “iceberg,” representing only a small, visible fraction of a much larger array of concealed problems in pet food safety. This result might stem from the fact that such incidents have occurred long ago (starting from 1976) or the fact that they have been deliberately ignored by specific authorities.

In contrast, information about the pet economy, such as historical trends and future predictions, is readily available. We ultimately select a dataset with the longest time span: *personal consumption expenditures: pets, pet products, and related services from 1929 to 2021* [29]. Ironically, our society appears to be more concerned with the frenetic pet economy and how to make money from pet owners than the harmfulness of pet food and the health of pets.

Unit Visualization Unit visualization [30] combines both the intuition of visual marks and abstraction of data to convey the data story in an expressive manner. It suits exactly our purpose of trending the expenditures in pet food and services versus cats dying of taurine deficiency.

We collect data on personal consumption expenditures in terms of pets, pet products, and related services from 1976 to 1981, attempting to show the striking contrast between the growing pet economy and the increasingly alarming problem of cats dying of taurine deficiency. Each image is bound with a specific number of consumption expenditures and the total consumption expenditures in each year. Each year is assigned a group of images. The more personal consumption expenditures spent in a year, the more images are stacked in that year.

Data Video Using AI-generated blind cats and unit visualization of pet economics data, we organize the story of taurine deficiency in cats into a data video ((Figure 6)). The video follows Freytag’s Pyramid narrative structure [31] to organize our story, starting from the background setting (e.g., the relationship between humans and pets), supporting facts (e.g., rising of pet economics), main insights (e.g., death of 6,000 cats), and the conclusion (e.g., a long-lasting and hanging matter, in terms of policy making and execution). We aim to use this accessible media type to reveal and convey these hidden incidents of pet food to the public (Figure 7).

Critical Discussion

Although a policy is published in 1981, recommending adding the least amount of taurine in pet food, the incidents of pet death caused by the lack of taurine in pet food have continued to happen. Even in recent years, there have also been death incidents reported, mainly related to dogs. Two pet dogs have both been diagnosed with diet-related taurine deficiency accompanied by disease-dilated cardiomyopathy (DCM), and the 3-year-old one have died [32].

Yet, to the best of our knowledge, there have been no recall cases regarding taurine deficiency in pet food. This reminds us to think about a line of questions. Is the policy mandatory? Have all the pet foods on the market undergone related expensive testing? When finding insufficient taurine in pet food, will pet owners be notified, or will the pet food be recalled? These are all open questions. A clinical finding published in 1992 believes that cat diseases such as dilated cardiomyopathy (DCM) and retinal degeneration are related to existing pet foods. The situation improves slightly as pet manufacturers realize the problem of taurine deficiency and increases its content [33].

The only official event we find publicly available is the incident in 2018. The FDA begins investigating reports of canine DCM in dogs eating certain pet foods [28] and collecting case reports from pet owners whose pets has died. As a result,

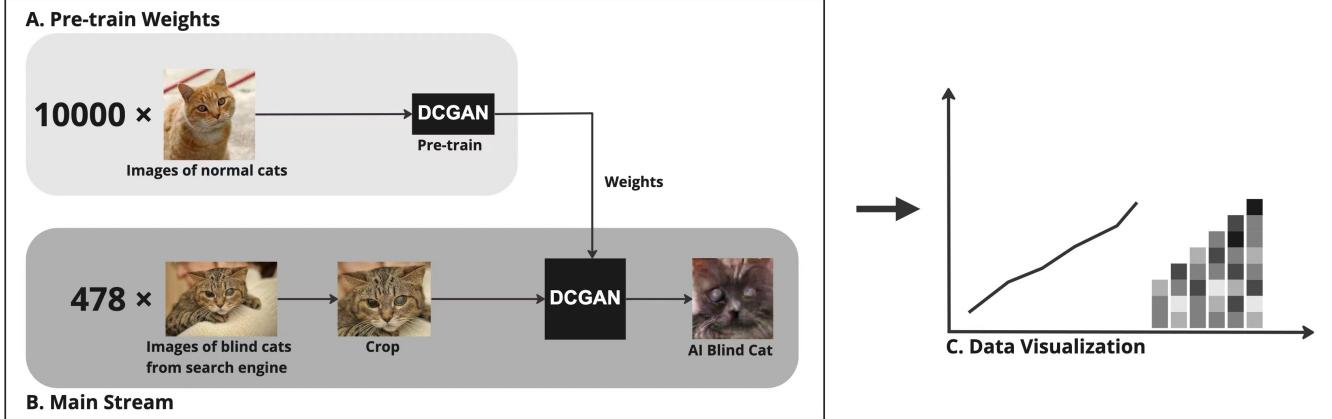


Figure 5: AI Transformation of normal cats to blind ones. ©Ziwei Wu and Xiaofu Jin.



Figure 6: Money is flipping into portraits of cats. Example portraits of AI-generated blind cats in data video. ©Ziwei Wu, Xiaofu Jin and Danlu Fei.

in 2019, the FDA receives 276 reported cases (273 canine reports, three feline reports), and most of these pets have only eaten dry pet food [28]. Ironically, in the end, the FDA claims that these death reports could not establish a causal relationship with the reported product [28] and ends this investigation without further action.

Researchers and scientists have, however, published many articles with cases to claim the link between dog disease and taurine deficiency in pet food years ago [34]. The gap between research findings and policy execution is apparent and frustrating.

The portrait of 6,000 AI-generated blind cats is just a microcosm of death due to taurine deficiency in pet food. Even though standards for taurine in pet food have been published for a long time, challenges in testing and ineffective policy implementation continue to result in the loss of animal lives. The rapid expansion of the market has precipitated the abrupt revelation of numerous overlooked issues. Yet, we never know how deep the world is under the surface, which is composed of countless hidden incidents that happened due to pet food issues.



Figure 7: Exhibition view with audience. ©Photograph by Ziwei Wu.

Conclusion and Future Work

We have conducted comprehensive research, with a particular focus on incidents related to pet food issues. In this work, we have selected taurine as a case study and used AI and computational approaches to portray the alarming issue of taurine deficiency in cats. We hope our work can tell the resilient and hidden story of the incidents of taurine deficiency in pet food, raise awareness, and inspire collective action in society. Having created portraits of 6,000 cats that died from taurine deficiency in pet food by training an AI model, we further visualized these 6,000 cats with real data to reveal the relationship between the pet capital markets and the deaths of cats. The data only focuses on profit and economic growth, without paying attention to the loss of animal life behind it, and we wish to use AI technology to fill in this missing part of history and connect through time.

This is merely the first step of “Hidden Incidents of Pet Food”. We are also investigating pet food incidents containing melamine and pentobarbital. Ultimately, we hope to make more comprehensive findings and produce a collection of work that utilizes different techniques to restore and represent these incidents in the future. Through our research and artworks, the public will hopefully be aware of the problems that occur “everywhen” in pet food. Rethinking the relationship between humans and pets, economics, and lives under capitalism.

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