A Spectral Approach to Ghost Detection

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**Abstract**—A large number of algorithms in optimization and machine learning are inspired by natural phenomena. However, so far no research has been done on algorithms inspired by supernatural phenomena. In this paper we survey our groundbreaking research on this direction, with algorithms inspired on ghosts, astral projections and aliens, among others. We hope to convince researchers of the value of not letting research be constrained by reality.

**Index Terms**—Spectral and Astral Methods, Trans-Dimensional Group Lasso, Ghosts, Occult, Hauntology, Crystal Energy, Supernatural, Paranormal

1 INTRODUCTION

Many algorithms in optimization and machine learning are inspired by natural phenomena. Some examples, in no particular order, include:

- Falling down a slope. [Robbins and Monro (1951)]
- Climbing up a hill. [Kernighan (1970)]
- Gravity [Rashedi (2009)]
- Iron cooling down [Hastings (1970)]
- Immune system behavior [Farmer et al. (1986)]
- Meme spreading [Moscati (1989)]
- Ant colony exploration [Dorigo (1992)]
- Honeybee mating behavior [Haddad et al. (2006)]
- Bee colony exploration [Karaboga (2005)]
- Glowworm communication [Krishnanand and Ghose (2009)]
- Firefly communication [Yang (2008)]
- Musicians playing in tune [Geem et al. (2001)]
- Mosquito swarms [Kennedy and Eberhart (1995)]
- Honeybee swarms [Nakrani and Tovey (2004)]
- Locust swarms [Buhl (2006)]
- Krill swarms [Gandomi (2009)]
- Cat swarms [Chu et al. (2006)]
- Magnetism [Tayarani (2008)]
- “Intelligent” water drops falling. [Shah (2009)]
- River formation [Rabanal (2008)]
- Frog leaping [Huynh (2008)]
- Monkey search behavior [Mucherino]
- Cuckoo search behavior [Yang and Deb (2009)]
- Bat echolocation [Yang (2010)]
- Galaxy evolution [Shah-Hosseini (2011)]
- Spirals [Tamura and Yasuda (2011)]

Clearly the bottom of this barrel has been thoroughly scraped. Therefore we propose to move towards algorithms inspired by supernatural phenomena. In this paper we survey our groundbreaking work on algorithms on this area. We give a brief synopsis of each of our main results and conclude with some ideas for future research.

2 RELATED WORK

Outside of the occasional use of oracles, there is no real use of supernatural phenomena within computer science. The most closely related bodies of work are ancient and esoteric methods of prediction such as necromancy (performing prediction by posing queries to the deceased), and multilevel modeling.

3 ALGORITHMS

3.1 A spectral approach to ghost detection

Ghost detection is a task that is currently painstakingly done by humans, often with high false positive rate and astoundingly low true positive rates, as documented in *Ghost Hunters* and *Most Haunted USA*. It is possible these researchers have been using unsuitable priors on ghost presence. We proposed to use the proven effectiveness of machine learning and computer vision to build a system for automatic ghost detection.

As can be seen in Figure 1, local “spectral” power is a strong cue to ghost presence. We created a system based on spectral analysis. We trained a Support Vector Machine with thousands of labeled examples to detect ghosts. Some example detections showing the effectiveness of our approach are shown in Figure 2.

3.1.1 Application: automatic ghost removal

Often ghosts, orbs and other supernatural appearances can show up and ruin otherwise perfectly fine pictures. We have developed a Photoshop plugin to automatically detect and remove these annoyances. An example result is shown in Figure 3.
3.2 Paranormal distribution modelling

The so-called “Normal” distribution is a relatively well known probability distribution function used to model various phenomena such as (TODO). It is not very interesting, which is why we propose to replace it with the Paranormal distribution. The formulation was inspired by the terrible and forbidden secrets in a manuscript found among the ruins of a nameless city in Iran.

\[ X \sim PN(\gamma, \phi, \mu, \sigma) \]

We can not write out the analytic formula for this distribution; we foolishly tried to derive it but were nearly driven mad by the dark and twisted symbols contained within. The best we can do to convey the idea is the diagram in Figure 4.

3.2.1 Occult variables

While indubitably powerful, the expressiveness of the paranormal distribution is limited by its unimodality. To enhance the power of paranormal distributions we introduce mixtures of paranormal distributions:

\[ Z \sim \text{Mult}(\theta_1, \ldots, \theta_K) \]

\[ X|Z \sim PN(\gamma_k, \phi_k, \mu_k, \sigma_k) \]

where \( Z \) is an occult variable (also known as “latent” or “hidden” variables in less esoteric literature) that indexes the parameters of the Paranormal distribution (see Figure 5). Naturally, estimation in such a model is fiendishly complex. We resort to maximizing the likelihood with the esoteric optimization algorithms outlined in Section 3.4.

3.3 Dimensionality shifting with astral projections

There are several algorithms in the literature to reduce the dimensionality of the data with discriminative or informative projections, such as principal component analysis (PCA) or linear discriminant analysis (LDA). There are also various kernel algorithms to implicitly or explicitly increase the dimensionality of data to a Hilbert space that increases class separability. But no algorithms exist so far to transcend and shift between dimensions. We propose to achieve this by projecting the data onto the astral plane. In the astral plane everything is possible: see Figure 6. As a useful side effect of this approach we can estimate the quality of the projection by its OOBE (Out Of Body Error).
3.4 Esoteric optimization methods

The methods described above often require the solution of high-dimensional, trans-dimensional and non-linear optimization problems. To solve them we have developed various novel optimization algorithms.

3.4.1 Supernatural gradient descent via demon invocation

The so-called “Natural” gradient descent algorithm [Amari (1999)] is a popular variation of gradient descent for optimization, with an update written as

$$x_{n+1} \leftarrow x_n - \gamma_n (J^T J)^{-1} \nabla f(x_n)$$

we propose a supernatural gradient descent instead:

$$x_{n+1} \leftarrow x_n - \gamma_n \mathcal{R}^{-1} \nabla f(x_n)$$

In this algorithm we replace $J^T J$ with an invocation of demons that will rapidly drag our solutions to the depths of hell. A necessary condition for this to work is the sacrifice of at least one goat, a practice first popularized in the Deep Belief Net literature. We conjecture the amount of livestock that must be sacrificed is proportional to the difficulty of the problem, i.e., different classes of problems may be characterized by their goat-complexity.

3.4.2 ALIENS

The last resort. See Figure 7.

4 CONCLUSION AND FUTURE WORK

We have summarized our groundbreaking work on algorithms inspired by supernatural phenomena. We are currently working on various new papers in this vein, described below.

4.0.3 Learning Hauntologies

Learning ontologies is a popular topic in the Artificial Intelligence literature. We propose to learn Hauntologies, a related but more esoteric and powerful way to describe knowledge.

4.0.4 Crystal-energy-based models

Energy-based models are a popular way to describe dependencies between variables. However inference in these models is often intractable. We propose Crystal-energy-based models, which leverage the magical healing power of crystals to solve this problem.

4.0.5 Supernatural K-optimality

We are currently studying the Kabbalah, arguably the most K-optimal esoteric text, with the hopes of applying this deep esoteric knowledge to the study of Kardashian Kernel methods [Fouhey and Maturana (2012)].

REFERENCES


