The Search for a Title

A Profound Subtitle

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II Part Two

Part One

1. Fungus Is Fun!

1.1 Fungi in Ecological System

Fungi are pretty interesting because they're fun.

1.2 Citation

This statement requires citation [1]; this one is more specific [2, page 122].

1.3 Lists

Lists are useful to present information in a concise and/or ordered way[1].

1.3.1 Numbered List

1. The first item
2. The second item
3. The third item

1.3.2 Bullet Points

- The first item
- The second item
- The third item

1.3.3 Descriptions and Definitions

Name Description
Word Definition
Comment Elaboration

[1] Footnote example...

2. In-text Elements

2.1 Theorems

This is an example of theorems.

2.1.1 Several equations

This is a theorem consisting of several equations.

Theorem 2.1.1 — Name of the theorem. In $E = \mathbb{R}^n$ all norms are equivalent. It has the properties:

$$\big| ||\mathbf{x}|| - ||\mathbf{y}|| \big| \leq ||\mathbf{x} - \mathbf{y}|| \tag{2.1}$$

$$||\sum_{i=1}^{n} \mathbf{x}_i|| \leq \sum_{i=1}^{n} ||\mathbf{x}_i|| \quad \text{where } n \text{ is a finite integer} \tag{2.2}$$

2.1.2 Single Line

This is a theorem consisting of just one line.

Theorem 2.1.2 A set $\mathscr{D}(G)$ in dense in $L^2(G)$, $|\cdot|_0$.

2.2 Definitions

This is an example of a definition. A definition could be mathematical or it could define a concept.

Definition 2.2.1 — Definition name. Given a vector space E, a norm on E is an application, denoted $||\cdot||$, E in $\mathbb{R}^+ = [0, +\infty[$ such that:

$$||\mathbf{x}|| = 0 \Rightarrow \mathbf{x} = \mathbf{0} \tag{2.3}$$

$$||\lambda \mathbf{x}|| = |\lambda| \cdot ||\mathbf{x}|| \tag{2.4}$$

$$||\mathbf{x} + \mathbf{y}|| \leq ||\mathbf{x}|| + ||\mathbf{y}|| \tag{2.5}$$

2.3 Notations

Notation 2.1. *Given an open subset G of $\mathbb{R}^n$, the set of functions φ are:*

1. *Bounded support G;*
2. *Infinitely differentiable;*

a vector space is denoted by $\mathscr{D}(G)$.

2.4 Remarks

This is an example of a remark.

R The concepts presented here are now in conventional employment in mathematics. Vector spaces are taken over the field $\mathbb{K} = \mathbb{R}$, however, established properties are easily extended to $\mathbb{K} = \mathbb{C}$.

2.5 Corollaries

This is an example of a corollary.

Corollary 2.5.1 — Corollary name. The concepts presented here are now in conventional employment in mathematics. Vector spaces are taken over the field $\mathbb{K} = \mathbb{R}$, however, established properties are easily extended to $\mathbb{K} = \mathbb{C}$.

2.6 Propositions

This is an example of propositions.

2.6.1 Several equations

Proposition 2.6.1 — Proposition name. It has the properties:

$$\left| ||\mathbf{x}|| - ||\mathbf{y}|| \right| \leq ||\mathbf{x} - \mathbf{y}|| \tag{2.6}$$

$$||\sum_{i=1}^{n} \mathbf{x}_i|| \leq \sum_{i=1}^{n} ||\mathbf{x}_i|| \quad \text{where } n \text{ is a finite integer} \tag{2.7}$$

2.6.2 Single Line

Proposition 2.6.2 Let $f, g \in L^2(G)$; if $\forall \varphi \in \mathscr{D}(G)$, $(f, \varphi)_0 = (g, \varphi)_0$ then $f = g$.

2.7 Examples

This is an example of examples.

2.7.1 Equation and Text

■ **Example 2.1** Let $G = \{x \in \mathbb{R}^2 : |x| < 3\}$ and denoted by: $x^0 = (1, 1)$; consider the function:

$$f(x) = \begin{cases} e^{|x|} & \text{si } |x - x^0| \leq 1/2 \\ 0 & \text{si } |x - x^0| > 1/2 \end{cases} \tag{2.8}$$

The function f has bounded support, we can take $A = \{x \in \mathbb{R}^2 : |x - x^0| \leq 1/2 + \varepsilon\}$ for all $\varepsilon \in]0; 5/2 - \sqrt{2}[$. ■

2.7.2 Fungi is Ecologically Interesting

■ **Example 2.2 — Example name.** Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris. ■

2.8 Exercises

This is an example of an exercise.

Exercise 2.1 This is a good place to ask a question to test learning progress or further cement ideas into students' minds. ■

2.9 Problems

Problem 2.1 What is the average airspeed velocity of an unladen swallow?

2.10 Vocabulary

Define a word to improve a students' vocabulary.
Vocabulary 2.1 — Word. Definition of word.

Part Two

3. Fungus and Ecological System

3.1 Introduction

In Chapter 1 and 2 we've discussed the basic habits of fungus and gained an intuitive recognition of the basic functionalities of fungus. In this chapter, we're going to discuss the relationship between fungus and the ecological system. Firstly, let's discuss about the role fungus plays in the ecological system.

3.2 Recent Researches & Developments

Fungus is inevitable in the eco-system. It's the decomposer of the nature, and it contributes to the global carbon cycling greatly. Scientists have been interested in the topic for a long time, and the recent researches concern on this too.

Firstly, researches have shown that fungus is not only the decomposer of nature, but some of them are also constructors of nature. For example, Mycorrhizal Fungi are found to be the constructor of roots or root-like structures. Fungus is deemed to be strictly connected with many beings in many different forms, including:

1. Mutualism. The being and the fungus forms a relationship that they depend on each other and receive benefits from each other.
2. Commensalism. The being and the fungus gains partial benefit from the other. That is, either the being gains benefit from the fungus (and the fungus gain almost nothing from the being), or the fungus gains benefit from the being (and the being gain almost nothing from the fungus).
3. Parasitism. The being and the fungus gains one-direction benefit and loss from the other. That is, in most cases, the fungus is the parasite and it gains benefit from the being, but the being loses energy because of the fungus. In this manner, the fungus is "selfish".

Secondly, researchers have found that when there are a cluster of fungus, they tend to interact with each other and carry out a shape like two ripples. The graphs are illustrated below.

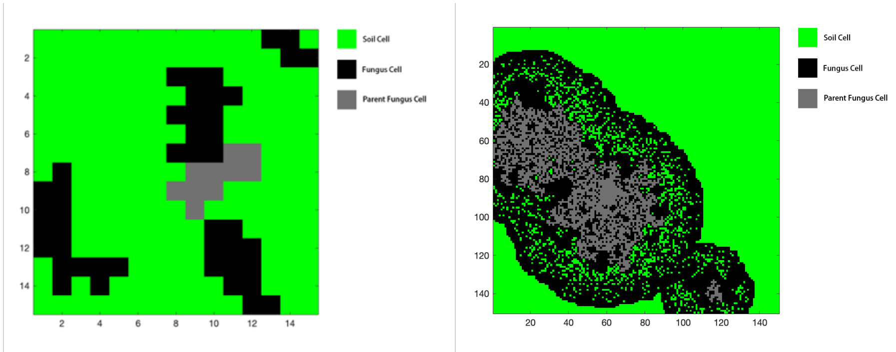

Figure 3.1: The Growth of Fungus by HPCA Algorithm, n = 15(left), n = 150(right)

These graphs are carried out by an advanced algorithm called HPCA (High-Precision Cellular-Automaton). This algorithm uses a large amount of cells to gain a visible output of the layout of the fungus in a certain area. As we see, when n (which can be used to represent the size of the area) grows larger, the statistics becomes more and more plausible. The result with n = 1,500, which should be really precise, is shown below.

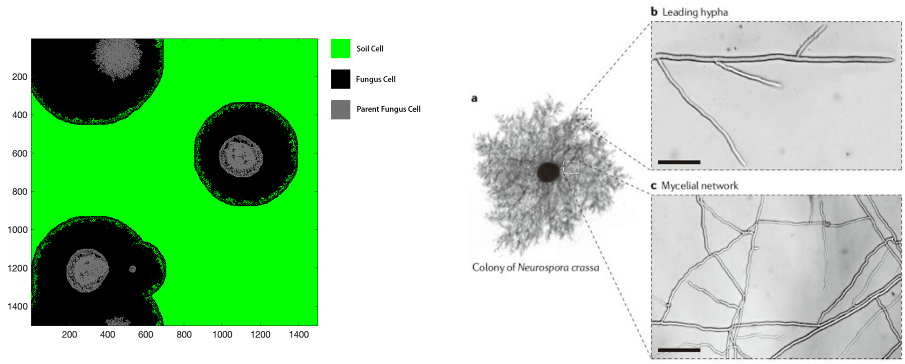

Figure 3.2: The Growth of Fungus by HPCA Algorithm, n = 1,500(left), Another Type of Fungus(right)

As we see, the fungus colonies can interact with each other and gain a shape like a "ripple". This is only one possibility (with a pretty low hyphal density), and other shapes include the graph shown on the upper right (from Wikipedia).

Thirdly, researches have shown that fungus has relationships with "themselves" - but different species. As this part is too much complex for an introductory course in the undergraduate course system, we'll only introduce the basic ideas. When different species meet each other, researchers have found that they'll "compete" with each other and "combat" to seize the territory. If you use HPCA to analyze it, it's similar to a question concerning a the ownership of the cell - the winner of the species will get this cell. Following this thread, you may want to look into the question, so we suggest you to do some research yourself (if you're interested in it).

Bibliography

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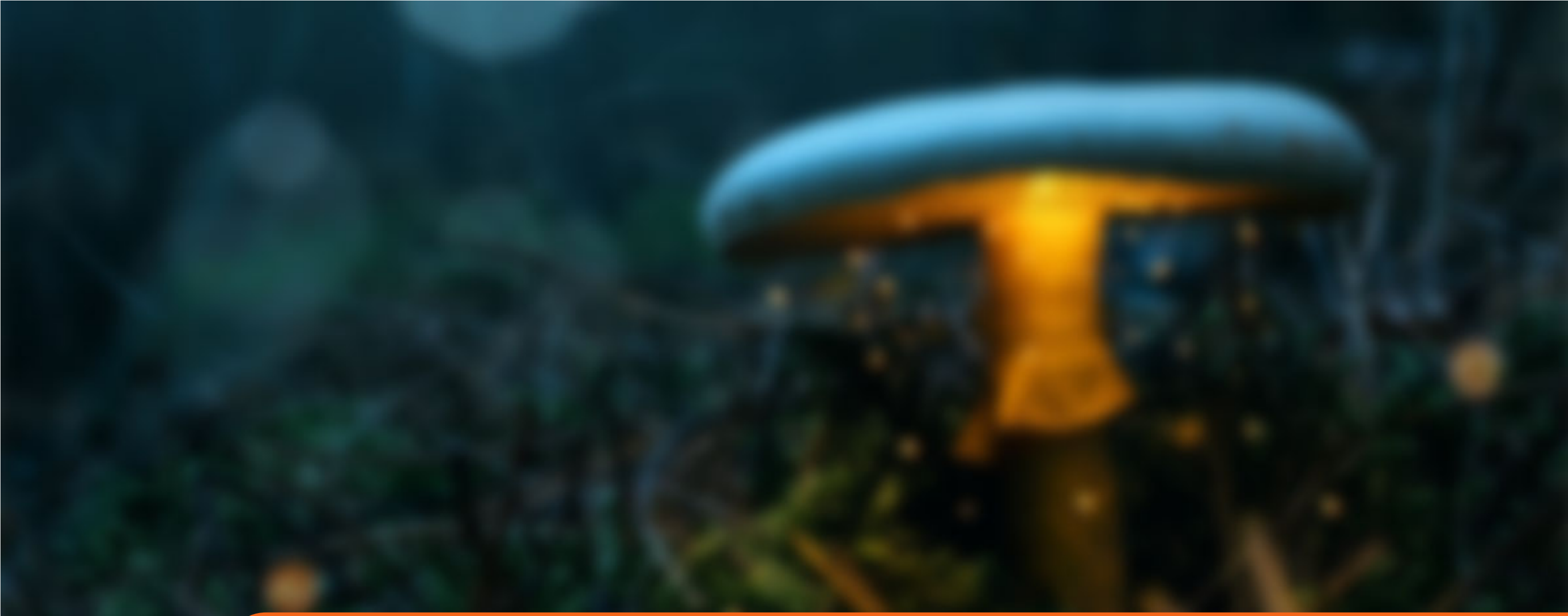
[Smi13] James Smith. “Article title”. In: 14.6 (Mar. 2013), pages 1–8 (cited on page 7).



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