Lecture 13 - Lindenmayer Systems

- L-systems can be:
  - deterministic or stochastic
  - context-insensitive or context-sensitive
  - parametric or not parametric
- L-systems have three components:
  - An alphabet - set of symbols
  - Axiom - starting symbol
  - Production rules
- An alphabet consists of variables - symbols, and constants - which are also symbols, but they cannot appear on the left side of the rule
- One possible interpretation of an L-system:
  - `0` - draw a line segment ending in a leaf
  - `1` - draw a line segment
  - `[` - push position and angle, turn left 45 degrees
  - `]` - pop position and angle, turn right 45 degrees

Stochastic vs Deterministic

- An L-system can be stochastic (probabilistic)
- Normal rule: `0 → 1[0]0`
- Probabilistic rules:
  - `0 (0.5) → 1[0]0`
  - `0 (0.5) → 0`

- Where the number in parentheses is the probability of applying this rule

Context Sensitive vs Context Insensitive grammar

- A context sensitive production rule looks not only at the symbol it is modifying, but the symbols on the left and right.
- Example production rule of a context sensitive gramma:
  - `b <a> c → aa`
- There can appear conflicts if both context sensitive and insensitive rules are used in one system
- We can resolve those issues by for example applying those rules that have the most context first

Parametric grammars

- All symbols are function that can have parameters
- Example string:
  - `a(0,1)[b(0,0)]a(1,2)`
  - Where numbers in parentheses are parameters
- This can be used to carry more information for the interpretation
- Arithmetic can also be used in the production rules
- Some rules may be applied only if some parameters fulfil some conditions, example:
  - `a(x,y) : x == 0 → a(1, y+1)b(2,3)`