Artificial Intelligence and Story

- Story generation
- Story understanding
- Drama Management
- Autonomous Characters

Story generation I: Morphemes & grammars

- Morphemes – story events or “functions”
  - Vladimir Propp analyzed Russian folk tales
  - Example morphemes: The hero leaves home, the hero is given a difficult task, the hero defeats the villain

- Grammars – hierarchic combination rules
  - Story grammars – use story functions by analogy to linguistic elements
Sample output & story grammar

Once upon a time there lived a dog. One day it happened that farmer evicted cat. When this happened, dog felt pity for the cat. In response, dog sneaked food to the cat. Farmer punished dog.

Story generation II: Author simulation

- Model authorial knowledge beyond story structure
- Examples: Authorial goals, plans, knowledge about the world
- We’ll look principally at two systems:
  - Universe (author plans)
  - Minstrel (models story goals, plans, creativity via reuse)

Story generation III: World modeling

- Model the a dynamic world and autonomous characters
- Stories emerge from the interaction of characters in the world
- We’ll look at Tale-Spin, the classic world modeling story generator, as well as more recent character-based AI research
- A challenge for this approach: autonomous characters running around in a world don’t necessarily create compelling stories
### Interactive drama

- User
- Presentation
- Drama Manager
- World
- Character

### Story AI: authorship and interaction

**The Enemy**

- Author has control **but**
  - All interaction paths must be pre-coded by author
  - Can only make very small stories
  - Bits of story can't be incrementally added

### Drama management

- Policy for “story piece” selection
- An alternative to explicitly coded links
Propp – Proto Grammar

- Structuralist analysis of the Russian folk tale
  - Morphemes (story events)
  - Rules for combining morphemes

- Work in AI story grammars builds on this tradition

- Much work in AI-based storytelling references back to Propp

Propp noticed regularities in folk tales

- Wanted to come up with a taxonomic system for describing folk tales

- Consider the regularities in...
  - "A tsar gives an eagle to a hero. The eagle carries the hero away to another kingdom."
  - "An old man gives Sucenko a horse. The horse carries Sucenko away to another kingdom."
  - "A sorcerer gives Ivan a little boat. The boat takes Ivan to another kingdom."
  - "A princess gives Ivan a ring. Young men appearing from out of the ring carry Ivan away into another kingdom."

- He wanted to capture these regularities in a formal notation

Examples of Proppian morphemes

- An interdiction is addressed to the Hero
  - "you dare not look in this closet"
  - "Take care of your little brother. Do not venture from this courtyard."
  - "Don’t pick up the golden feather."

- The villain makes an attempt at reconnaissance
  - A bear says “What has become of the Tsar’s children?”
  - A priest during confession: “How were you able to get well so quickly?”

- The villain causes harm or injury to a member of the family
  - The villain abducts a person
  - The villain seizes or takes away a magical agent
  - The villain pillages or spoils the crops
Example analysis

A tsar, three daughters (α). The daughters go walking (β³), overstay in the garden (δ¹). A dragon kidnaps them (A¹). A call for aid (B¹). Quest of three heros (C↑). Three battles with the dragon (H¹-I¹), rescue of the maidens (K⁴). Return (↓), reward (w⁰).

The master folktale equation

ABC↑DEFG HJK↓Pr-RsL QExTUW* LMJNK↓Pr-Rs

Story grammar systems

• Starts with the taxonomic impulse of Propp and uses formal grammars to capture story structure

• Formal grammar reminder
  ▪ Regular expressions: A → a, A → aB
  ▪ Context free: A → γ
  ▪ Context sensitive: αAβ → αγβ
  ▪ Universal: α → β

• Most story grammars tend to be context free
• Context sensitive grammars may be useful for rewriting the story (explicit story/discourse distinction)
Regular expressions

- You’re probably familiar with regular expressions
  - E.g. a(bc)^* describes patterns such as abbbc, a, acccc, but not aab
- This regular expression can be rewritten as the following regular expression grammar rules:
  - S → aX
  - X → bX
  - X → cX
  - X → ε
- What kinds of patterns can’t you capture with a regular expression?

Context free grammars

- Context free grammars are used for specifying programming language syntax and have been used for encoding natural language syntax
- Simple sentence example
  - Sentence → NounPhrase VerbPhrase
  - NounPhrase → Det Noun
  - VerbPhrase → Verb NounPhrase
  - Det → a
  - Det → the
  - Noun → cat
  - Noun → bat
  - Verb → eats
- Sentence generation example

Design grammars
### Joseph

- Story grammars have largely been dropped by the AI community because of the problems of over and under generation.
- Joseph is a more recent system that attempted to show the story grammar project can be successful.
- To generate concrete stories, adds a world model to instantiate primitives:
  - Models plan execution and its effects in the world.
  - Models all the actions and plans within the story space.

### Grammar analysis

### Story grammar issues

- How to “interactivize” story grammars?
- Granularity of morphemes – how should the morphemes be grounded?
- How do you represent more complex constraints?