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Automatic Story Generation Techniques: A Review

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ABSTRACT
Computational storytelling research involves understanding, representing, and creating stories. For us to be able to teach machines to compose their stories we have to know how humans tell stories. With this information, computer scientists are now able to simulate the human brain. Computer-generated narratives are useful to psychologists for the study of human cognition. Every narrative has a plot that details the events that took place and the reasons that caused them. The people who act out the tale or are affected by them are called story characters. The main character, who is usually the only one in short stories, plays a significant role in most of the storyline, events, and cause-and-effect relationships between them. In this paper various generative artificial intelligence-based methods are reviewed in terms of certain parameters for the automatic story generation.

Keywords – Artificial Intelligence, Narratives, Script, Story generation, Storytelling

1. Introduction

1.1. Definition and overview of Automatic Story Generation (ASG)

A story describes actors based on real life or fantasy and is written for one or more reasons, including to have fun or teach something. Stories usually consist of at least one theme, which is the main idea that the author wants the reader to take away from the story. A tale event is a specific time and place where an event happens and it alters the state of the world [1]. Every narrative has a plot that details the events that took place and the reasons that caused them. The people who act out the tale or are affected by them are called story characters. The main character, who is usually the only one in short stories, plays a significant role in most of the storyline, events, and cause-and-effect relationships between them. Space narrative's components are the people in a story [5], the location of the story, the things that the characters use and everything that is found in the narrative's environment, as well as the characters' imagination. The fabula represents the story world where events happen in a certain time sequence. The syuzhet is the selection of some parts of the fabula to be arranged in a special way to make the reader interested. The discourse is the form of a narrative according to the outer surface which consists of the syuzhet and more. The plot graph is a visualization used in narrative generation systems to plot the structure of the story.

A directed acyclic graph is utilized to account for the possibilities of event sequences given the fact that a story has been reduced to discrete plot points, each of which corresponds to a story event. These plot points are then given some ordering constraints. It is also possible to apply further disjunctive limitations to define the tale points that never come together. A script is a framework that tells the proper course of events in a certain situation. It presents a tale as a set of slots and specifies the restrictions for what can be included in them. The content that belongs to one slot may actually be determined by the content of other slots within the script [2]. Story frames serve as the actual representations of all these various components of a story. For example, a character frame holds the main details of a character, like their name, role, and status. On the other hand, event frames set the properties and limits of an event like the participants, the locations, and the actions that can be done to a certain extent. In order to create a more genuine atmosphere, the production team can also incorporate elements like the story time and place. Moreover, in order to result in the story's goals and provoke the interest of the audience, the plot of the story should be orderly arranged. A vast number of permutations exist for the task of compelling narrative from a story structure analysis. There are numerous models for analyzing and creating stories based on their structure. However, the most prominent and generally accepted story structure is Freytag's Pyramid, which consists of five principal components: Exposition, which is the part where the main characters and the story's settings are introduced. Rising Action, which means the movement of the events that gradually get to the climax of the story.

A Climax is the point when events soar to a peak in a story when the highest tension is achieved. The following stage of the plot is the Falling Action [3], this is the time that covers the events coming from the

Climax to the Resolution where the main problem in the story is solved and the story is over. Story structure is the unique thing that describes a story and its importance is not only to achieve the story's goal but also help the audience to stay interested. The way a story is told is basic to its logic, as every detail must be understandable for the readers. The three things that impact a story's consistency are: the cause-and-effect connections between events, the alignment of events with the story's world, and the harmony between characters' personalities and actions. Consistency is the story's most important quality. In other words, the consistency of the storyline is as important as the structure of the plot and it is the most necessary condition for any narrative to be created.

1.2. Importance and applications of ASG

ASG (Automatic story generation) commend creativity of the use of new ideas, and the narratives, thus enabling content generation at high volume, which is the personalization of user experiences in media and gaming. It also helps with language learning, therapy, and thus promotes the cultural diversity of the different types of storytelling. The main features include the ability to tell narratives that specifically target particular people and groups which are the reasons why the functions are applicable in different industries. Some prominent applications of ASG are discussed below:

- Creative Writing Tools: Writers and authors use AI tools in order to come up with ideas, develop plots, and even write a complete story [4]. Although these technologies are mostly used to help the creative people overcome their writers' block, they also boost the creative processes.
- Video Game Development: Story generation is used in video games, mostly in RPGs and interactive fiction, to create a plot that develops and changes according to the players' choices. As a result, the gaming experience is unique and personalized.
- Chatbots and Virtual Assistants: Storytelling is the key to making chatbots and virtual assistants capable of surprising users with human-like answers, thus, they can carry out more conversational-based and narrative interactions.
- Entertainment Industry: In film, TV, and digital content production, automatic story generation can be used for experimentation with a variety of script ideas, plot developments, and character arcs, thereby speeding up the creative process.
- Education and Training: Story generation is applied in educational tools to create personalized learning experiences, where adaptive narratives are crafted based on the learner's progress and interests, thus making the learning process more engaging.
- Marketing and Branding: Through story generation, businesses can come up with a captivating and creative way to tell their brand stories for advertisement, making it easier for them to bond with their target audiences.
- Cognitive Therapies: In therapeutic settings, the use of automatic story generation as a tool for individuals to create personal narratives has proven to be beneficial in cognitive-behavioral therapy by providing structured methods for the expression of emotion and processing of experiences [5].

1.3. Motivation and Research Gaps

1.3.1. Motivation

The motivation for automatic generation of stories is driven by the realization of literature producing systems through AI in almost all the sectors like entertainment, gaming, education, and marketing. As the need for the generation of creative content on-demand increases throughout various industries, it is of paramount importance to ascertain the advantages and disadvantages of existing techniques in order to move towards the next steps. The recent successes in Natural Language processing like the transformer-based transformer models introduced new opportunities, but still narrative coherence, creativity, personalization, and cross-cultural adaptability issues exist. It is possible that an evaluation of existing methodologies will shed light on how the systems can be enriched to produce more dynamic, emotionally engaging, and contextually appropriate stories. Moreover, dealing with ethical issues such as bias and representation is the further reason which necessitates the thorough analysis of the already existing technologies, thereby revealing the possibilities for more inclusive and responsible storytelling models.

1.3.2. Research Gaps

The subsequent section draws out the key research gaps in the field of Automatic Story Generation (ASG).

- The digital content economy is booming, which brings about the growing desire for scalable and effective solutions that can deliver captivating stories across multiple sectors such as the entertainment, gaming, education, and marketing sphere. A synthesis of the progress in automatic story generation can reveal developments and gaps that dominate that are mainly related to this.
- Automated story generation is a tool for human creativity that comes through ideas, plot plans, and

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character development. Through its evolution in this field of study, users can gain insight into new ways in which artificial intelligence can work with artists to expand the horizons of storytelling.

- With great improvements in NLP, such as the creation of transformer-based models (e.g., GPT and BERT), it is time to evaluate whether these advances are used to generate stories, and to point out the strong and weak sides of these models.
- The increased use of AI in content generation comes with some important ethical questions that society is faced with such as the bias, representation, and the potential for misinformation. A comprehensive review can motivate the development of more responsible and ethically sound models.
- As storytelling becomes more diverse from text and reaches analog and digital formats such as video games and virtual environments, and as global cultural diversity takes on more and more importance, reviewing current research can motivate further development in generating culturally inclusive and multimodal narratives.

1.4. Paper Organization

Section 1 mentions Automatic Story Generator (ASG) in detail. It provides a definition of ASG, describes its objectives and diverse applications, and points out the research gaps and needs for this review.
Section 2 presents the fundamental concepts and the background related to ASG. The history of ASG is discussed, the theories of narratology, cognitive science, and linguistics that provide a basis for story generation are mentioned, and a brief introduction to natural language processing (NLP) and machine learning (ML) concepts applied in ASG is given.
Section 3 is mainly concerned with the representation of stories and modeling techniques. It presents story schemas and frameworks such as narrative graphs and story grammars, and then goes on to explore character and entity modeling, representation of events and actions, as well as the modeling of story worlds and settings.
Section 4 reviews the key techniques used in story generation. It covers rule-based systems, Case-Based Reasoning, transformer-based approaches, stochastic and probabilistic models, and hybrid approaches for automatic story generation.
Section 5 provides a wide description of the evaluation and assessment methods of ASG systems. It mentions several evaluation metrics including coherence, creativity, and engagement, it compares human evaluation with automated metrics, and it solves the problem of evaluating ASG systems. Additionally, it provides an overview of the most commonly used assessment frameworks and tools.
Section 6 is a discussion of real-life applications and areas where ASG is used. These include Interactive Storytelling, Education, Advertising, Assistive Technologies, Digital Humanities, as well as Virtual and Augmented Reality.
Section 7 analyzes ASG both from the challenges and the future directions perspectives. It discusses the complexity and scalability of ASG systems, the importance of diversity and inclusivity, the integration of human feedback, and overcoming the narrative paradox. Furthermore, it points out the newly emerged trends and research avenues that are associated with a specific area.
Section 8 sums up the review with an outline of the key breakthroughs, an evaluation of the current state of ASG research, and suggestions for potential future research areas.

2. Background and Foundations

Every culture is endowed with a powerful story element that attracts people of the entire age group. Because of this, stories have been the vehicle of inspiration, the vehicle of moral education, and the vehicle of the amusement [6]. In recent years, narratives have also been utilized as a teaching tool and as a method of assessing students. Storytelling is a fundamental ingredient in human communication. Narratives are an effective device for interpersonal communication. People get in touch with a story that is well told better than with any other sources. Nonetheless, computers still have a long route to automatically telling stories. Nevertheless, due to technological developments, the issue of computational narrative also known as automated tale generation has gained popularity. Computational narrative is vital because it enriches the man-machine interaction. The's computer natural language processing is improved with the help of automated narrative generation, and computer storytelling brings human and computer relationship closer. Computational storytelling research involves understanding, representing, and creating stories. For us to be able to teach machines to compose their stories we have to know how humans tell stories. With this information, computer scientists are now able to simulate the human brain. Moreover, computer-generated narratives are useful to psychologists for the study of human cognition. The ability to autonomously generate stories in real-time, for example, in games, is a benefit as it opens up a range of possibilities for different kinds of applications [7]. Furthermore, the stories that are customized to students' needs could also be

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employed in education. The promotion of interactivity in games is one of the catalysts that push developers to create more immersive gaming experience.

2.1. Heading History of Automatic Story Generation

Stories are a significant part of every culture, attracting people regardless of age. For that reason, stories have always been a medium for entertainment, moral lessons, and wisdom inspiration. In recent decades, stories have also been used as tools for assessing and educating children. We may define creativity as the ability to generate novel and valuable ideas, where valuable means beautiful, interesting, and useful. Generating stories using computers is a complex task of computational creativity, which lies in the area where psychology and artificial intelligence (AI) intersect. To teach computers how to generate a story, we need to understand how humans create one. Knowing this enables computer scientists to mimic the human brain. However, generating stories using computers helps psychologists better understand human cognition. Although story generation systems started in early 1960s, they did not achieve outstanding results and are still classified as weak AI systems because their creativity is not comparable to humans. For a computer system to be creative, it must generate stories different from past seen ones [8]. Many attributes must be considered, including story settings such as time and space, story characters, their desires, and plans to achieve these desires. In addition, the interactions between characters and conflicts that may occur between characters' desires are essential. These attributes result in an enormous growth of the story space, and hence searching for a story in this vast space is difficult, inefficient, or impossible. The large number of attributes makes story generation difficult, and accounting for its aim, believability, and interestingness further complicates the generation process. Open story generation, where stories are generated without relying on a priori engineered domain models, adds two extra challenges to story generation: the automatic construction of the domain model and evaluating the story progress to guide the generation process. As a long-standing problem, computational narratives received many efforts to survey and classify story generation systems. This survey provides an overview of the available knowledge sources for developing story generation systems and outlines the different evaluation metrics commonly used in the literature. Additionally, it discusses the factors that contribute to story interestingness. This work serves as an up-to-date review by covering several newly proposed studies that were not included in previous surveys.

2.2. Relevant theories from narratology

A narrative can be delineated as an act of a sequence of actions and events unfolding over time, ruled by the causal principles. These are the laws that govern the occurrence of events in a logical and coherent way. The agents of other actions must come first, which emphasizes the intertwined nature of logical (if x, then y), causal (because of x, then y), and temporal order (first x, then y) [9]. Coherence also comes from the fact that there are no irrelevant details, a notion first put forward by Aristotle in his Poetics. In the same vein with Barthes, it was stated that the story is made up of many parts and the presence of each part is determined by a function that is related to the meaning of the story. The role of these elements is usually linked to the character's desire or motivation. A simple story outline consists of a location and a character with a clearly defined purpose that may be either obstructed or facilitated by other events. It is often the case that in well-done narratives, the audience is left to decide on the relevance of each element of the narrative. While real-world attention is directed by immediate goals, in literary narratives, one must interpret the intentions behind the story's elements. If a story mentions a specific event or character, it is assumed to be relevant to the protagonist's objectives. In automatic story generation, narratology offers critical frameworks for structuring narratives, developing characters, and guiding the progression of the story. Following are the relevant theories from narratology:

- Structuralism: Vladimir Propp's Morphology is a system that summarizes a folktale into a sequence of 31 functions and character types. These elements are the ones which give structure to the characters (for example, hero, villain, helper), common narrative patterns (quest, struggle). Owing to its design, this method accounts for the fact that technological systems can be programmed to follow a certain structure while creating narratives.
- Narrative Grammar: Story grammars are formalized ways of representing how stories are structured, this is similar to how language is structured in grammar. Through the use of a hierarchical and rule-based system, story grammars set out the components like settings, plot points, conflicts, and resolutions, thereby providing a way to automate the structures of stories. This theory is often employed together with algorithms to create coherent plots [10].
- Theories of Plot Development: Freytag's Pyramid subdivides a plot into five elements: exposition, rising action, climax, falling action, and denouement. The classic structure of narrative exposition provides a framework for shaping the story arcs of the automatic story-generating systems by defining the way how tension and events should develop and resolve, thus providing a roadmap for the narrative flow.

• Three-Act Structure: The three-act structure is prescribed by most screenwriters and narrative constructors. It divides the story into setup, confrontation, and resolution. This outline is usually interfaced with various story generation algorithms to produce narratives with clear beginnings, middles, and ends. This way the generated stories can have a clear logical progression.
• Fabula and Syuzhet: This concept clarifies the distinction between fabula (the linear sequence of the events in the order they occurred) and syuzhet (the way the narrative has been ordered). The proposed method is suitable for automatic story generation as it gives the systems an opportunity to experiment with the presentation of events (for instance, through the use of flashbacks, flash-forwards, or broken narration) while still being coherent.
• Cognitive Narratology: Cognitive narratology emphasizes how different readers comprehend and understand stories, through mental models and expectations that lead to narrative comprehension. This is of utmost importance in automatic story generation because it gives the developers the opportunity to model user interaction and how the stories can adjust to the reader's preferences or reactions [11].
• Mimesis vs. Diegesis: The difference in the ways of mimesis (showing) and diegesis (telling) is the two different styles of storytelling automatic systems can use. Automatic systems can be designed to choose between more descriptive, immersive storytelling (mimesis) or more abstract, summarizing narration (diegesis) based on the desired effect.
• Interactive Narratives and Emergent Storytelling: In interactive and emergent storytelling systems, theories of non-linear narrative and player agency have become the key concepts. These methods deal with the idea of producing multiple storylines based on the user's choice in a dynamic way, thus making the story more personal and varied in the outcome.

2.3. Cognitive Science and Linguistics Foundations

The roots of the automatic story generation systems can be traced back to the research carried out in different fields, especially to cognitive science and linguistics. These domains give rise to the theories and models that explain the various ways in which people create, structure, and communicate stories, which are vital in the automation of these processes [12]. Cognitive science is concerned with the way people think, learn, and process information, which, in turn, acts as a useful commentary on the mechanics of story creation. Researchers explore the way the brain organizes knowledge using mental structures such as schemas and scripts, which are the ones that allow individuals to predict and comprehend narrative sequences. Automatic story generating approaches generally make use of these models for the purpose of guiding narrative composition. Moreover, human research on memory, specifically episodic memory (which consists of information based on events), provides directions for training machines to remember stories and to establish the order of events. Memory models of AI can imitate the way characters have a recollection of the past and it can determine their future course of action. Telling stories is a process of inventing new ideas to the questions the narrative poses such as why the conflicts or how the story goes to a coherency. Cognitive models of problem-solving like divergent and convergent thinking are the ones that give algorithms the answering guidance in storytelling generation. Basically, linguistics gives the frame of how language is utilized to communicate stories, laying down the rules and structures for narrative expression. The main linguistic concepts related to automatic story generation are: When you check your paper on a black-and-white hardcopy, please ensure that:
• Syntax and Grammar: Indeed, grammatical rules are the pillar of syntactic models in enabling automated story generation to produce text that is grammatically correct. The parsing methods enable the systems to comprehend the sentence structure and utilize rules to create the cohesive narrative units.
• Semantics: Semantics besides grammar involves meaning, coherence, and meaningfulness of the narratives generated. To infer relationships between words and concepts, thereby ensuring the logical connections are made among narrative elements, semantic networks, ontologies, and deep learning models are used.
• Discourse Analysis: Discourse analysis studies how such units as paragraphs or even whole stories are structured. Discourse models are automatic generators built to make sure that [13] events in the story are in the right order and that there is coherence between the different parts of the narrative.
• Pragmatics: Pragmatic principles guide how context influences meaning, such as how characters' goals, intentions, and interpersonal relationships affect their dialogue and actions. Understanding pragmatics helps in developing more realistic and context-sensitive narratives.
• Narrative Linguistics: This subfield is concerned solely with the shape of the stories, such as plot, characterization, and theme. Through the analysis of traditional narrative frameworks, for example Propp or Labov, the story generation systems can either replicate conventional storytelling or create their own stories within the framework.

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2.4. Overview of natural language processing (NLP) and Machine Learning concepts

Natural language is one of the most important approaches that make us different from other animals. Without it, human thoughts would be difficult to express and, therefore, natural language processing (NLP) is crucial for machines to read, understand, and derive meaning from human languages [14]. NLP, a module of AI, is a multidisciplinary field that encompasses AI, computer science, and linguistics, also known as computational linguistics. It is concerned with creating a two-way conversation between humans and machines in natural language, so that machines can process, understand, and use human languages like English and Chinese. NLP creates such functionalities for instance, automatic speech recognition, text generation, and processing big data sets, hence, it is a contributor to the efficiency of automatic summarization and machine translation. NLP has two main perspectives: research and application. Research in NLP entails syntax analysis, semantic analysis, and text comprehension. On an application level, NLP has a lot of potentials, particularly in the information age, involving machine translation, speech recognition, information retrieval, text classification, opinion mining, and many more. NLP is a hybrid subject, which can be related to data mining, machine learning, knowledge acquisition, and AI research. The main goal of NLP is to train machines to learn and produce human language. It has been successfully implemented in diverse domains such, as for example, voice assistants Lambdas and Tmall Genie as well as in machine translation and text filtering. The use of machine learning, especially deep learning, has received a huge boost from the development of NLP. This discipline can be split into the following three sections:

- Speech recognition: This helps to convert audio into text [15].
- Natural Language Understanding (NLU): This can be defined as the ability of machines to comprehend human language.
- Natural language generation (NLG): NLG allows computer to produce human lie language.

In the field of story generation, continuous interest has been limited, but recent years have seen a surge in using machine learning (ML) techniques for this purpose. Thinking of a story to be a series of actions, ML models understand the relation between events in a story corpus, which they learn on a conditional probability basis. Deep learning, which is a part of ML, learns features and representations automatically, to be able to capture the representations that are at different levels. Machine learning, including its applications in natural language processing, such as machine translation, sentiment analysis, and question-answering systems, is one of the areas where deep learning has contributed. On the whole, the contribution of deep learning to language technology, including the generation of stories, is extracting complex patterns from data and improving the tasks related to language.

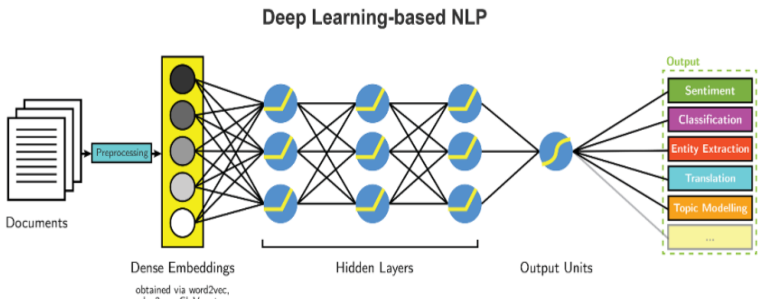

Fig. 1. Deep learning approach for NLP

Deep learning-based NLP is characterized by an abstraction hierarchy which is represented as a vector. Old school methods basically focused on the lengthy labeling of data but deep learning uses vectors for representing words, phrases, logical expressions, and even sentences. Such a technique effectively combines [16] deep networks with human language, thus facilitating the capability of neural networks to understand text better. Words are represented as encoded vectors through the methods of one-hot encoding and word embeddings. Then, a multi-layer neural network is trained to learn these representations alone. Deep learning in NLP gives more priority to semantic representation than syntactic representation.

3. Story Representation and Modelling

3.1. Story Schemas and Frameworks

Story schemas and frameworks are structured approaches that give the necessary order to different narrative elements, directing to the creation of meaningful, coherent stories. Narrative graphs and story grammar (a couple of major approaches) are the two main ones.

- Narrative Graphs: Narrative graphs, a visual representation of the structure of a story, are composed of nodes that contain events, actions, or states and the edges that express relationships or causal links among these elements. This graph-based model gives the flexibility of non-linear storytelling, thus, letting the systems move in different plot trajectories [17]. By allowing the events to be reordered or modified according to user input or some predefined rules, narrative graphs facilitate such dynamic storytelling. These graphs find their application in the fields of interactive storytelling and procedurally generated narratives in games and simulations. In a narrative graph, an event like "Character A saves Character B" might lead to "Character B becomes loyal to Character A", with subsequent actions branching based on this relationship (e.g., "Character B helps Character A in a battle" or "Character B betrays Character A").
- Story Grammars: Story grammars have a formal set of rules for generating stories, just as sentence grammars govern language structure. They break down a story into its components (for example, setting, characters, conflicts, resolutions) and explain how these elements can be put together. This means that stories that are generated will have traditional narrative arcs, like Freytag's Pyramid (introduction, rising action, climax, falling action, resolution). A story grammar may require that a story starts with an introduction of characters and setting, then a conflict is introduced, and finally a resolution that ties up the loose ends is given.

3.2. Character and Entity Modelling
Character and entity modelling, which is inspired by the development of believable and dynamic characters and objects, is concerned with creating the story in a proper way. Characters and objects are regarded as core ingredients in the story construction, and their modelling process could be described by constructing their characteristics, drives, and relations.

- Character Modeling: Characters are generally modelled using a set of characteristics, called goals, beliefs, personality traits, emotions, and backstories. These attributes are useful to creating the character's behaviour and speech consistent [18]. In story generation, characters are often presented to be with some internal states (like e.g., fear, loyalty) and processes of decision-making that are similar to human ones, allowing such characters to respond to the events of the story like humans. Tools like Theory of Mind enable systems to mimic the way characters infer and interpret each other's intentions, thus, making character interactions more vivid. A character who has the goal of vengeance will behave differently to a character who is looking for peace. Their goals will shape how they interact with the other characters; hence, they will be the main driving force of the plot.
- Entity Modeling: Entities are non-character objects in the story world, such as artifacts, locations, or even abstract concepts like "freedom" or "honor". Moreover, these entities could be given particular properties or features that can stand for their connections with the characters in such a way that they could be the influencing elements of the narrative. For instance, it can be a magical artifact: it can enhance the possessor and, in that way, it can be a game-changer in the way the characters are influenced. One of the key examples in "The Lord of the Rings" is the One Ring, which is a character with enormous power over the plot. It is the One Ring that determines the character's actions and influences the course of the whole narrative [19].

3.3. Event and Action Representation
Actions and events are the main elements in any narrative, they signify the happenings that drive the story. For the automatic story generation, events and actions should be in a structured way that can be operated by the machines.

- Event Representation: Events in a story can be thought of as moments where something significant happens that changes the state of the world or the characters. These events need to be encoded with information about who, what, where, and when they occur, as well as the relationships between events (e.g., cause-effect relationships). Events can be categorized into atomic events (single actions like "John picks up a sword") and complex events (sequences of actions, like "John fights the dragon"). An event like "The hero slays the dragon" might be followed by "The townspeople celebrate," creating a causal link between two story events [20].
- Action Representation: The actions are highly specific to the characters they are referring to and are frequently motivated by their goals. They are modelled by determining the actor, the target, the sort of action (verbal, physical, etc.), and, of course, the intended result. Actions can involve a decision-making process based on the state of the character at the time, therefore it's important to monitor how they affect the story world to maintain continuity. Interesting plot turns could result from a sequence of events starting with "The king declares war" and ending with "armies prepare for battle".

3.4. Story world and Setting Modelling
Setting and environment are the background of the story world. They set the stage for the characters and the

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coming events. Further, the story world is essential in determining the rules and restrictions around which the story will be constructed.

- Story world Representation: A story world is all the places, things, characters, and laws that create the universe the story is set in. This encompasses both specific environments (for instance a medieval castle or a futuristic city) and conceptual elements (for instance social hierarchies, or magical laws). When a story is generated automatically, the setting of the story should be precisely defined and all the connections between the items, places, and characters should be made clear. It is a strategy that enables the creation of entertaining and authentic plots. For example, a fantasy story world may have limitations on how magic can be used, such as "only wizards can cast spells," which will in turn influence the plot and the characters [21].
- Setting Modeling: The moments and areas where the story's events are taking place can be called the setting. Planning the physical, social, and cultural aspects that shape the narrative is one more. To illustrate, the standards and obstacles of a dystopian future novel may differ from the ones of a historical romance. The story generation systems can create environments that are plausible enough and can change the plot and character behavior just by building these elements. The limited resources scenario in the apocalyptic world is the reason why the main themes of the story would be around fighting for food and water.

4. Story Generation Techniques

Artificial intelligence (AI) and computational creativity are integral parts of Automatic story generation (ASG). ASG focuses on generating narratives using algorithms. The key approaches used in automatic story generation are discussed below:

- Rule-Based Systems: Rule-based systems that relied on predefined rules and templates were used in early approaches to ASG for story generation [22]. They are deterministic systems derived from logic theory and syntax patterns. The “Tale-Spin” system (1970s) simulated characters with goals and plans to generate simple narratives, which were thus, coherent but simplistic.
- Planning-Based Approaches: In systems that are planning-based, the story appeared to be the problem of the planning where the system came up with a series of actions to achieve a narrative goal. These systems illustrate the characters' actions and interactions to make a plot coherent. The "Plot Machines" framework deals with using AI planning techniques for the generation of stories by first the system determining the sequence of events required to reach a desired outcome.
- Case-Based Reasoning (CBR): CBR approaches generate stories by adapting and reusing the components from existing ones. The system retrieves a story from a database that is somewhat similar to the desired story and modifies it to fit the new requirements. The “Mexica” system, which generates stories by balancing between story tension and coherence, using cases of existing stories as references, is an example of this.
- Stochastic and Probabilistic Models: These models utilize probability methods like Markov chains, Hidden Markov Models (HMMs), or probabilistic context-free grammars to produce stories. These treatments, thus, characterize the likelihood of certain words or sequences of events. Markov models have been used to write texts in such a way that they predict what will come next word or phrase, based on the previous one, thus resulting in statistically coherent, even though at times quite disjointed, stories.
- Neural Network-Based Approaches: The most recent development in ASG is mainly the result of neural deep learning models [23]. The models identify certain schemes from the big datasets of narratives and hence are capable of producing human-like texts. In the old neural approaches, RNNs and their variants (e.g., LSTMs) were used first to cope with the sequential nature of the stories. Yet, they frequently encountered the problem of maintaining long-term coherence.
- Transformer Models: The use of transformers, e.g. GPT (Generative Pre-trained Transformer), made ASG much better. These models are basically the next word in the sentence, and they are good at writing stories that most of the time make sense and are coherent for long texts. GPT-3 and GPT-4 are well-known transformer-based models that are able to produce complex and coherent stories.
- Hybrid Approaches: Hybrid means the use of different approaches in order to tap into the strengths of each. For instance, rule-based systems and neural networks can be combined to produce a story that follows a specific logical pattern and maintains fluency. Systems that incorporate planning for plot generation and neural networks for natural language processing (NLP) for the purpose of enhancing the narrative's fluency.
- Interactive Storytelling: Some of the systems ASG are aimed at interactive storytelling where the user has the power to choose the path of the story [24]. These systems are always at odds with the user for input and the narrative is a coherent combination of planning and machine learning techniques. Interactive fiction games or AI-driven narrative experiences where the plot transforms according to player choices.

C. A. Dos Santos, (2024) presented an AI-driven user story generation model created user stories using two distinct methods: one based on N-gram representation with linguistic heuristics, and the other utilizing the

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GPT-3 model [25]. They evaluated this work using multiple user story organizations and evaluated the results using BLEU, ROUGE-N, and BERTScore metrics. For the N-gram method, this was obtained an average score of ROUGE-N = 0.39, BLEU = 0.26, and BERTScore = 0.73. In comparison, the GPT-3 model scored ROUGE-N = 0.46, BLEU = 0.27, and BERTScore = 0.69. This analysis showed that while the GPT model was better at generated detailed user stories, the N-gram model exhibited greater semantic precision. Considered its simplicity and low workload, they recommend using the N-gram approach for generating user stories. C.Tang, T. Loakman, et al. (2024) presented EtriCA, a novel neural generation model designed to improve the fidelity and coherence of generated stories [26]. EtriCA achieved this by using an interactive process that transfered details from event to event through residual mapping. This model leveraged a feature capturing mechanism to more effectively utilize logical relationships between events during story generation. To further enhanced the model, they apply a post-training framework called KeEtriCA, which was designed for knowledge enhancement using a large-scale book corpus. This approach allowed the model to adapt to a broader range of data samples, resulting in approximately a 5% improvement in automatic metrics and over a 10% improvement in human evaluations. They conducted extensive experiments, including comparisons with state-of-the-art (SOTA) baseline models, to assess the performance of our framework in story generation.

T. Rahman, et al. (2023) introduced a new autoregressive diffusion architecture with a visual memory unit that automatically captured the context of actors and backgrounds throughout the produced frames [27]. By used sentence-conditioned soft attention over memories, this was approached effectively resolved references and maintains consistency in scenes and characters when required. To test this method, they expanded the MUGEN dataset by adding new characters, backgrounds, and multi-sentence storylines. They experiment on the MUGEN, PororoSV, and FlintstonesSV datasets demonstrate that this approach not only surpasses previous methods in generating high-quality, story-consistent frames but also effectively models the relationships between characters and backgrounds. Y. Xie, et al. (2022) aimed to utilized contrastive learning to produce story ending that were more coherent with the given context. There were two main challenges in using different learning methods for SEG (Story Ending Generation). The first challenge involved the effective negative sampling of ending that do not align with the story context [28]. To tackle these two challenges, proposed a novel CLseg (Contrastive Learning framework for Story Ending Generation), which involved two key steps: multi-aspect sampling and story-specific contrastive learning. For the first challenge, they use innovative multi-aspect sampling technique to generated incorrect story endings by taking into account order consistency, causality, and sentiment. To addressed the second challenge,they designed a story-specific contrastive training strategy tailored for story ending generation. Experiments demonstrated that CLseg surpasses baseline methods and produces story endings with enhanced consistency and rationality.

G. George et al. (2022) developed a system designed to retrieve story based on input keywords. The stories must relate to the given keywords. They used the ROCStory dataset and preprocessed the data using the msmarco-distilbert-base-prod-v3 sentence transformer [29]. For story retrieval, they employed a search technique with FAISS (Facebook AI Similarity Search). The selected stories were converted to audio using pyttsx3. They compared the performance of our approach with the baseline method, which used the paraphrase-MiniLM-L6-v2 sentence transformer, through a subjective evaluation. The results indicate that our approach outperforms the baseline method. J. Chen, et al. (2021) introduced the Control-and-Edit Transformer model, a new way to generate controllable and editable story plots [30]. Our approach was based on the assumption that the story's ending verb can serve as a control goal. Unlike previous techniques for controllable neural plot generation, this approach allowed for flexible plot manipulation, including adding or removing elements through a novel editing process guided by imitation learning. This ablation analysis demonstrated the significance of the proposed components. Future work will focus on developing a comprehensive neural generation tool for practical real-world applications. L. Mo, et al. (2021) proposed a GMTF (Gated Mechanism-based Transformer Network) to enhance story ending generation by ensuring it aligns sentimentally with the given context [31]. This approach involves using VADER, a sentiment analysis tool, to captured the sentimental trend of the story context. This sentimental information was combined with the contextual data and fed into a transformer network to extract key elements. A gated mechanism was employed to filter out irrelevant information, and the attention layer weights for both the encoder and decoder are shared to optimized the use of contextual clues. Experimental results on the ROCStories dataset showed that our method achieved 27.03% on BLEU-1, 7.62% on BLEU-2, 1.71 on Grammar, and 1.31 on Logicality.

K. Min, et al. (2021) presented an encoder-decoder system designed to generate a (short story captioning) used a signature image corpus and a book story corpus [32]. The paper highlights three main points: 1) It introduces an unsupervised deep learning algorithm that combined RNN (recurrent neural networks) with encoder-decoder models to generate image-based short stories, 2) It provides a large database of cover

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stories and a reference book in two genres - horror and romance, 3) Extensive testing shows that the stories created by the design yield more creative content than generating short sentences. The framework is capable of generating artificial intelligence and can be integrated into applications to help writers develop new ideas.R. Cantoni, et.al (2020) introduced a novel approach for Constrained Story Generation, employing a two-layered architecture [33]. The Plot Generation layer operated on two levels of abstraction simultaneously: it used human-authored probabilistic graphs to model scenes, while a recursive algorithm arranges these scenes into a sequence, added a new subplot to overcome obstacles in the generation process. To ensure compliance with constraints and specifications, the system encoded the state of the generation using principles from classic AI (STRIPS) and logic programming. The output from this layer feeds into the Text Generation layer, which reintroduced semantic meaning by employing a human-authored dictionary and appropriate structure to model the state of text generation, thereby appropriately substituting keywords with existing names.
G. Chen, et al. (2020) developed a novel approach for creating explainable plots in neural story generation, designed to generate fluent, coherent, and reasonable stories [34]. Unlike existing methods, this model can automatically produce a high-level, explainable plot that connected the title to the story, addressing the information gap. The experiments on two benchmark datasets demonstrated that our approach surpasses state-of-the-art techniques in both automatic and human evaluations. While current focus was on using a one-sentence outline to bridge the gap between a title and a short story, modelling cross-sentence dependencies in longer stories remains a significant challenge. To address this, they plan to extended their method to generated multiple-sentence outlines, which will help in creating more coherent and extended narratives. L. Wang, et al. (2019) developed a new method for generating translation projects in neural story generation, aimed to create smooth, coherent, and believable narratives [35]. This model stands out from existing systems by effectively managing high-level processes, such as linking nouns to the storyline and integrated diverse data sources. Testing on two datasets has demonstrated that this method outperforms current state-of-the-art systems in both automated and human evaluations. While they successfully used descriptive sentences to connect titles and short stories, modelling sentences in longer stories remains challenging. To tackle this, they plan to enhanced this approach by generating multi-sentence descriptions to ensure a unified and compelling narrative.

Table 1. Comparative analysis of Existing approaches

Author & Year	Technique used	Parameters	Findings	Limitations
C. A. Dos Santos (2024)	AI-Driven User Story Generation (N-gram, GPT-3)	ROUGE-N, BLEU, BERTScore	N-gram model shows higher semantic sensitivity, while GPT-3 excels in generating comprehensive user stories.	GPT-3 model requires more computational resources and may not be as semantically sensitive as the N-gram model.
C. Tang, T. Loakman, et al. (2024)	Neural Generation Model (EtriCA) with Cross-Attention Mechanism	Automatic Metrics, Human Evaluation	EtriCA improves relevance and coherence in generated stories, with a 5% improvement in automatic metrics and 10% in human evaluation.	Potential challenges in adapting the model to different domains without additional fine-tuning.
T. Rahman, H. - Y. Lee (2023)	Autoregressive Diffusion-Based Framework with Visual Memory Module	MUGEN, PororoSV, FlintstonesSV Datasets	Outperforms prior SOTA in generating frames with high visual quality and consistent story context.	Limited to datasets used; might not generalize well to other types of story generation tasks
Y. Xie, Y. Hu, L. Xing (2022)	Contrastive Learning for Story Ending Generation (CLseg)	Multi-Aspect Sampling, Story-Specific Contrastive Learning	CLseg produces more consistent and rational story endings, outperforming baselines.	Challenges in negative sampling and adaptation of contrastive learning for broader applications
G. George, R. Rajan, et al. (2022)	Keyword-Based Story Generation Using Sentence Transformer and FAISS Search	Subjective Evaluation	The proposed model outperforms baseline methods in generating relevant stories based on input keywords.	Subjective evaluation limits the generalization of findings; may not perform as well in different contexts.
J. Chen, G. Xiao, et al. (2021)	Control-and-Edit Transformer Model for Controllable Neural Story Plot Generation	Ablation Analysis	The model allows for flexible and controllable plot generation, demonstrating significant improvements over previous methods.	Needs further development for real-world applications and broader control scenarios.
L. Mo et al. (2021)	Gated Mechanism-Based Transformer Network (GMTF)	Sentimental Trend, BLEU, Grammar, Logicality	GMTF achieves higher consistency in story endings with sentimental context, showing competitive results on ROCStories dataset.	Focused primarily on sentimental consistency, potentially overlooking other important aspects of

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				story coherence.
K. Min, M. Dang, H. Moon, et al. (2021)	Encoder-Decoder Framework for Short Story Captioning (SSCap)	Unsupervised Deep Learning, RNN, Encoder-Decoder Model	The framework shows creative content generation with potential for AI story writing applications.	Limited genre scope (horror and romantic), which may not generalize to other genres or styles.
R. Cantoni, J. Essenziale, et al. (2020)	Constrained Story Generation Using a Two-Layered Architecture	Probabilistic Graphs, Recursive Algorithm	The model ensures adherence to constraints and specifications, generating coherent story plots.	The complexity of the architecture may limit scalability and flexibility in different story generation tasks.
G. Chen, Y. Liu, H. Luan, et al. (2020)	Explainable Plot Generation for Neural Story Generation	High-Level Plot, Benchmark Datasets	The method outperforms SOTA in generating fluent, coherent, and reasonable stories with explainable plot structures.	Struggles with cross-sentence dependencies in long stories, requiring further development for longer narrative coherence.
L. Wang, S. Qin, et al. (2019)	Neural Open-Domain Story Generation with Latent Variable Modeling	Pre-Trained BART Language Model, Human Evaluation	The model improves coherence and relevance in generated stories, outperforming baselines.	Potential for logical conflicts and lack of long-range cohesion in generated stories.

5. Evaluation and Assessment

5.1. Evaluation metrics for ASG

Following are the evaluation metrics for ASG

- Coherence: The logical relationship between two successive paragraphs is measured by coherence. This metric attempt to evaluate the created text's coherence and sense-making as a whole.
- Engagement (EG): A more subjective criterion linked to projecting volitive modality—which prompts the reader to make a subjective assessment and express a desire to see something accomplished—and story outcome—which serves as a catalyst for story liking—is engagement, which measures the reader's level of engagement with the narrative.
- Empathy (EM): This indicator gauges how well the reader grasped the character's feelings and is based on the significance of passionate, empathetic writing [36].
- Logicality: This assesses how well the events, motivations, and character behaviours in created stories fit within the input contexts. A good story should support the conclusions drawn by the listener. For automated measurements, the logicality is challenging to quantify.
- Creativity: Character attributes, the setting in which the story takes place, and figures of speech are all examples of how creativity is expressed in human-authored narratives.
- Consistency: This assesses whether the generated stories and the provided background are related to each other and follow a set of guiding principles. Certain contradictions inside a story are similar to protagonists acting "beyond character", or the settings of stories contradicting one other before and after.
- Informativeness: This dimension represents the level of understanding that users are able to get from reading the created stories. Similar goals are served by the coverage metric, which counts the occurrence of knowledge triples without taking knowledge relevance into account. Even if two generated sequences may have the same number of knowledge triples, the triples that they contain may differ greatly in terms of their informativeness.
- Interestingness: A story's level of interest is difficult to assess, yet it matters to readers. Even if a tale is coherent and reasonable, it might not be engaging. These days, research only allows humans to determine an engaging tale based on their personal preferences, which can differ from person to person. Perhaps there is still a long way to go before the story's interest level can be automatically determined [37].

5.2. Human evaluation vs. automated metrics

Although several criteria have been offered, there is no clear consensus on the optimal criteria for human evaluation in automatic story generation (ASG). Fluency, coherence, inventiveness, faithfulness, fidelity, grammar, logicality, and general excellence are examples of common requirements. The variations such as pairing tasks, faithfulness, and fidelity, which are related to relevance, and logicality and narrative flow, which are related to coherence, show how these criteria frequently overlap. Certain criteria, such emotion faithfulness and outline use, are unique to certain contexts. Evaluation protocols usually use only two or three criteria, which is inadequate for thoroughly evaluating a work as complicated as story generation, even if ASG is a complex process. Furthermore, these methods frequently don't include explicit instructions, including employing Likert scales with thorough explanations to reduce subjectivity [38].

While there are many more measures available, most automated ASG research uses metrics like BLEU and

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ROUGE. These fall into two categories: reference-based, which contrast generated stories with a reference (human-written) story, and reference-free, which assess the story on its own and frequently take the original prompt into account. Model-based, embedding-based, and string-based metrics are included in each area. String-based metrics have trouble with synonyms and paraphrases but excel at analyzing the actual text. This is addressed by embedding-based metrics, like word2vec or BERT, which assess the contextual links between words. Lastly, model-based metrics use regression analysis or trained language models to grade the material that is produced.

5.3. Challenges in Evaluating ASG Systems

The subjective and intricate nature of storytelling poses a number of significant issues when evaluating Automatic Story Generation (ASG) systems.

- Lack of Standardized Evaluation Criteria: The selection of evaluation criteria is a topic on which there is no consensus. Although they are commonly used, metrics like narrative flow, coherence, fluency, and creativity are arbitrary and susceptible to interpretation. Comparing different research works' applications of different or overlapping criteria makes it challenging to draw conclusions between them.
- Subjectivity in Human Evaluation: Because different human assessors evaluate elements like creativity or involvement differently [39], story quality is essentially subjective. Without standardized Likert scales with detailed descriptions or clear criteria, assessments might become uneven and produce incorrect findings.
- Overlapping and Vague Metrics: It might be challenging to distinguish clearly between many evaluation criteria, such as faithfulness, fidelity, and relevance, since they sometimes overlap. Additionally, some measurements could not fully account for the intricacy of storytelling, especially when it comes to artistic elements like character development or emotional effect.
- Balancing Multiple Aspects of Story Quality: Plot, character development, emotional engagement, structure, and many other interconnected factors are all present in stories. It can be difficult to evaluate these factors in their entirety because many methods currently in use only pay attention to two or three factors, which might not adequately represent the full depth or quality of a narrative [40].
- Automated Evaluation Limitations: Even though they are frequently employed, automated metrics like BLEU and ROUGE are not ideal for assessing creative writing. These string-based techniques suffer with synonyms, paraphrasing, and deeper story elements like coherence, inventiveness, or character consistency. Instead, they concentrate on superficial comparisons (like word overlap).
- Context Sensitivity: Because ASG systems are context-dependent, two narrative prompts may result in distinct tale results due to minute differences in system behavior or architecture. Another level of complexity is determining how well a story fits the prompt or context.
- Handling Long-Form Text: Long tales produced by ASG systems are more difficult to assess than shorter writings. Large-scale narrative frameworks are difficult for automated metrics to evaluate, and it can be difficult for human evaluators to remain consistent while examining lengthy stories.

5.4. Evaluation Frameworks and Tools

The frameworks for evaluation, which are employed to appraise the effectiveness of VSG models, offer numerical metrics for evaluating the calibre and consistency of the narratives that are produced. The majority of these metrics were first created for summarization or machine translation, but the community has since adopted them for other tasks like creating stories and captions for images [41]. In these cases, the generated text is compared with a reference story for story generation, or with a reference caption for images, rather than a translation. The following section discussed frequently used metrics, along with their advantages and disadvantages.

- Perplexity: Autoregressive language models' performance is assessed using Perplexity. It is defined as the exponential average negative log-likelihood of a sequence and quantifies the model's predictive power: The perplexity of a tokenized sequence $X = (x_1, x_2, \ldots, x_N)$ where N is the sequence length, can be found using Eq. 1. $P(x_i|x_1, \ldots, x_{i-1})$ indicates the likelihood that a token, token xi, given the previous token sequence $x_1, \ldots\ldots, x_{i-1}$ as predicted by the model. The geometric mean of the word sequence's inverse probability, or perplexity, can be used to calculate how accurately the model predicts each token in the sequence that comes after it. Better predictive performance is indicated by lower numbers, indicating that the model is more successful in capturing the language's underlying structure.

$$Perplexity(X) = \sqrt[N]{\prod_{i=1}^{N} \frac{1}{P(x_1|x_1, \ldots\ldots, x_{i-1})}} \qquad (1)$$

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- BLEU-n: The quality of generated text is assessed by Bilingual Evaluation Understudy (BLEU) through comparison with one or more reference texts. Although it was created for machine translation applications, it is now used for many other natural language generating applications, such as VSG. The similarity between the created and reference texts is shown by a score that BLEU generates, which ranges from 0 to 1 [42]. Greater alignment with the reference is shown in higher scores; full agreement is represented by a score of 1. BLEU computes the precision of these matches, which are unaffected by the text's position, by comparing the n-grams in the candidate text with the n-grams in the reference texts. The main assumption is that the text quality increases with the number of matching n-grams. BLEU includes a brevity penalty in order to counteract the bias towards shorter texts, which may have higher precision. By striking a balance between recall and precision, this penalty makes sure that the metric doesn't unfairly favor shorter stories. The shortness penalty (Eq. 3) is represented by BP in Eq. 2, the weight for each n-gram is represented by wn, the n-gram precision is represented by Pn, and the number of bigrams, trigrams, and four-grams is normally up to four.

$$BELU = BP.\,exp\left(\sum_{n=1}^{N} w_n \log p_n\right) \qquad (2)$$

$$BP = \begin{cases} 1 & if\ c > r \\ e^{(1-r/c)} & if\ c \leq r \end{cases} \qquad (3)$$

Even though it's commonly used, BLEU can't evaluate stories with original language, synonyms, or word changes. Because of its inability to recognize semantic equivalency when alternative phrase or phrasing is employed, its emphasis on exact n-gram matches may penalize stories that are stylistically distinct but conceptually accurate. As a result, evaluations of idiomatic expressions, linguistic richness, and the nuances of creative language use are less successful [43].

- METEOR: To overcome some of BLEU's shortcomings, Metric for Evaluation of Translation with Explicit ORdering (METEOR) was created as a tool for evaluating machine translation outputs. Its goal is to obtain a stronger correlation with human judgments by concentrating on sentence-level evaluation. The statistic is based on the harmonic mean of unigram recall and precision, with recall being prioritized to better match the evaluative preferences of humans. First, the algorithm focuses on unigram mappings and aligns the candidate text with the reference text. Every unigram in the candidate text must align with either zero or one unigram in the reference text for these mappings to be considered valid. To guarantee coherence and clarity, configurations with the fewest crossing lines are given priority during the alignment process [44].
- ROUGE: ROUGE (Recall Oriented Understudy for Gisting Evaluation) focuses more on how much of the target sequence can be recalled in the generated sequence than BLEU-n, which computes overlap between two sequence segments. When n is set to 1 or 2, it determines the normalized number of n-grams from the target sequence that occur in the created sequence. The infamous "one-to-many" problem in narrative generation allows for the possibility of numerous excellent sequential sequences inside the same story context, but only one target sequence is provided. Thus, the ability to generate open-world stories is restricted for both ROUGE and BLEU-n.
- CIDEr: The original idea of CIDEr (Consensus-based picture Description Evaluation) was to assess picture captions. Compared with the above n-gram matching assessment metrics, CIDEr further employs tf-idf (Term Frequency Inverse Document Frequency) to weight various n-gram when assessing similarity. As a result, CIDEr can concentrate on "important" words in order.
- BERTScore: In contrast to earlier approaches that determine syntactic similarity at the token level, BERTScore uses the contextual embeddings produced by BERT to calculate the similarity between the created sequence and the target sequence [45]. The pairwise cosine similarity between two embeddings is used to calculate the scores. In terms of matching the semantics of two sequences, BERTScore is far more adaptable. Due to the comparison between just embedding and not words, the grammatical faults, however, might be overlooked.
- UNION: UNION is a Bert-based metric that may measure a created story without requiring a target sequence as a point of comparison. It has been taught as a classifier with the goal of separating narratives written by humans from negative examples. Repetition, substitution, reordering, and negation change are some of the operations used to construct these negative samples. As a result, UNION can identify problems with created stories that are frequently noticed, such as recurring plots and logical conflicts.
- MAUVE: Using divergence frontiers, MAUVE compares the learned distribution from a language model to the distribution of texts written by humans. The quality of created stories can be influenced by various factors such as length, decoding technique, and model size. Current metrics do not analyze or record these attributes [46].

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6. Applications and Domains

Applications for Automatic Story Generation (ASG) are numerous and span many different domains. The following are important areas where ASG technologies are being used.

- Interactive Storytelling and Games: ASG is crucial to the development of dynamic and flexible storylines in interactive fiction and video games. ASG can be used by games to create original plots depending on the decisions made by the user, resulting in individualized and captivating experiences. ASG is useful for developing branching narratives and non-linear storylines in games like Dungeons & Dragons and narrative-driven role-playing games, which increase player involvement.
- Education and Training: ASG may develop storytelling-based classes and individualized learning materials for students in the field of education. It can be used in situations like language learning, where students can practice reading, writing, and understanding by listening to stories created by AI. ASG systems imitate real-world scenarios [47] in training environments, particularly in domains like corporate or military training, giving students the opportunity to practice making decisions in narrative-driven simulations.
- Advertising and Marketing: Using ASG, compelling storylines for ad campaigns are produced. Businesses use story creation systems to create immersive brand stories or tailored marketing messages that appeal to particular target demographics. Brands may use ASG to automatically produce tailored email campaigns, product descriptions, and social media posts that engage customers and build stronger relationships.
- Assistive Technologies and Accessibility: The development of assistive technologies, which help those with disabilities, is done using ASG. For people with cognitive disabilities, for instance, it can create individualized or simplified narratives that make material easier to understand. The creation of alternate formats, such as audio stories or simplified text, for those with learning difficulties or visual impairments can also be facilitated by story generation.
- Digital Humanities and Cultural Preservation: By reenacting folktales or historical narratives from many cultures, ASG helps preserve cultural heritage [48] in the field of digital humanities. ASG contributes to the preservation of endangered languages, narratives, and traditions by creating stories that depict historical events or cultural myths, keeping them alive for future generations. Virtual heritage tours and interactive museum exhibits that engage and educate the public can also be created using this technology.
- Virtual Reality (VR) and Augmented Reality (AR): ASG creates adaptive storylines in real time to improve immersive experiences in VR and AR. In virtual settings, ASG can design dynamic narratives that react to user activities, offering different experiences every time a person logs in. By adding story layers to physical locations like historical reconstructions or interactive museum exhibitions, AR can help ASG overlay stories onto the real world and enhance everyday encounters.

7. Challenges and Future Directions

Although Automatic Story Generation (ASG) is still in its early stages of development, there are a number of obstacles that need to be overcome before it can reach its full potential. Key issues and future directions are listed below:

- Handling Complexity and Scalability: Dealing with the difficulty of crafting cogent, lengthy tales is one of the main issues facing ASG. It gets harder to maintain character development, story progression, and logical coherence in longer or more complex works. Sophisticated planning and narrative modeling techniques are needed to scale story generation systems to accommodate intricate plots, many protagonists, and entwined subplots. The development of algorithms that can manage complex narrative structures while preserving coherence and engagement should be the key goal of future effort [49].
- Addressing Diversity and Inclusivity: ASG systems frequently have trouble portraying a range of cultures, viewpoints, and characters. Biases in the training data for AI models can occasionally be reflected in the stories the algorithms produce. Developing mechanisms that can provide narratives that are gender-sensitive, culturally aware, and representational of diverse populations is necessary to address inclusion. In order to ensure equitable and inclusive storytelling, the future of ASG will entail curating more diverse datasets and creating algorithms that can generate stories reflective of a wide range of human experiences.
- Integrating Human Feedback and Collaboration: Even with the increasing sophistication of ASG systems, human involvement is still crucial for improving narrative development. Creating frameworks that enable seamless human-AI collaboration and enable interactive storytelling—in which users can direct or alter the story—remains a difficulty. A growing body of research is focused on enhancing story quality, inventiveness, and relevance by incorporating real-time human feedback. In the future, ASG systems might combine user-guided tale modifications with AI-driven generation to enable co-creative storytelling experiences.
- Overcoming the Narrative Paradox: The narrative dilemma describes the difficulty in striking a balance between the requirement to preserve [50] a consistent and organized narrative and user freedom in

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interactive storytelling. It can be challenging for the system to adjust when users or players make choices in a tale and yet produce a coherent, relevant plot. Future work might concentrate on enhancing AI's capacity to dynamically modify stories in real-time, making sure that user activities impact the narrative without compromising emotional resonance or plot integrity.

8. Conclusion

In summary, ASG is the storytelling area noticeably accelerated by the latest technologies in the case of fields such as education, cultural preservation, and interactive gaming. The major conclusions indicate that ASG systems employ various methods, for example, hybrid approaches, planning-based, evolutionary algorithms, template-based, and language model-based procedures. Each of these approaches has its own advantages and disadvantages, including the need to preserve narrative coherence, move the story, and accommodate user input. Despite significant progress, key obstacles in ASG research remain, including fostering diversity and inclusivity, managing narrative complexity and guaranteeing scalability, and integrating human participation. Furthermore, the “narrative paradox” still poses a challenge, especially in interactive storytelling, where achieving the ideal balance between user autonomy and logically developed stories can be challenging. Themes including multimodal storytelling, emotional intelligence, procedural content creation, and ethical concerns abound in ASG research. With advancement in overcoming these obstacles, AI and human ingenuity will work together to create ASG systems in a variety of applications. The future research in this field should concentrate on developing more inclusive, scalable, and adaptive story generating approaches in order to fulfill the demands of such narratives, which are becoming more complex and dynamic.

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