Free and Fully Open Source AI Text-to-Speech Solutions

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Chapter 1: Introduction to AI Text-to-Speech: Understanding the Basics

Artificial Intelligence (AI) has revolutionized numerous fields, and one of the most fascinating applications is Text-to-Speech (TTS) technology. TTS systems convert written text into spoken words, enabling machines to "speak" in a human-like voice. This technology has become increasingly important in various domains, from accessibility tools for the visually impaired to virtual assistants and even content creation in the adult industry. In this chapter, we will explore the fundamentals of AI Text-to-Speech, its underlying concepts, and practical applications.

What is Text-to-Speech?

At its core, Text-to-Speech is a technology that synthesizes speech from text input. The process involves several steps, including text analysis, linguistic processing, and speech synthesis. Let's break these down:

1. **Text Analysis**: This initial step involves parsing the text to understand its structure. For example, the system identifies punctuation, sentence boundaries, and the context of words. This is crucial because the way a word is pronounced can change based on its context. For instance, the word "lead" can be pronounced as "leed" (to guide) or "led" (a type of metal), depending on its usage.
2. **Linguistic Processing**: After analyzing the text, the system converts it into phonetic representations. This means translating the text into sounds that correspond to the letters and syllables. Phonetics is the study of sounds in human speech, and understanding it is essential for creating natural-sounding speech.
3. **Speech Synthesis**: Finally, the phonetic representation is transformed into audible speech using various synthesis techniques. The two primary methods are concatenative synthesis, which pieces together pre-recorded speech segments, and parametric synthesis, which generates speech using algorithms. The latter is often used in modern AI TTS systems, as it allows for more flexibility and natural-sounding output.

Types of Text-to-Speech Systems

There are several types of TTS systems, each with its own strengths and weaknesses. Here are a few common types:

- **Rule-Based Systems**: These systems rely on a set of predefined rules to convert text

into speech. While they can produce intelligible speech, they often lack the naturalness and expressiveness of more advanced systems.

- **Statistical Parametric Speech Synthesis**: This approach uses statistical models to generate speech. It can produce more natural-sounding voices than rule-based systems, but it may still sound robotic compared to human speech.
- **Deep Learning-Based Systems**: Recent advancements in AI have led to the development of TTS systems that utilize deep learning techniques. These systems, such as Google's WaveNet and OpenAI's Jukebox, can generate highly realistic and expressive speech by learning from vast amounts of data. They can even mimic specific voices, making them ideal for applications in entertainment and personalized content.

Practical Applications of TTS

The applications of TTS technology are vast and varied. Here are some practical examples:

- **Accessibility**: TTS plays a crucial role in making digital content accessible to individuals with visual impairments. Screen readers, which use TTS technology, read aloud text displayed on a screen, allowing users to interact with websites and applications.
- **Virtual Assistants**: AI-powered virtual assistants like Amazon's Alexa and Apple's Siri use TTS to communicate with users. These systems can answer questions, provide information, and even control smart home devices, all through natural-sounding speech.
- **Content Creation**: In the realm of content creation, TTS can be used to generate voiceovers for videos, podcasts, and audiobooks. This is particularly useful for creators who may not have the resources to hire voice actors. For instance, platforms like Descript allow users to create audio content using TTS technology, streamlining the production process.
- **Gaming and Entertainment**: TTS is also utilized in video games to provide character dialogue and narration. This enhances the gaming experience by making it more immersive and engaging.

Open Source TTS Solutions

For those interested in exploring TTS technology without the constraints of proprietary software, there are several free and fully open-source TTS solutions available. These tools allow developers and enthusiasts to experiment with TTS systems, customize them, and even contribute to their improvement. Some notable examples include:

- **Mozilla TTS**: An open-source TTS engine that uses deep learning to produce high-quality speech. It supports multiple languages and can be trained on custom datasets, making it a versatile choice for developers.
- **eSpeak**: A compact, open-source software speech synthesizer that supports a wide

range of languages. While it may not produce the most natural-sounding speech, it is lightweight and easy to integrate into various applications.

- **Festival**: A general framework for building speech synthesis systems. It offers a variety of voices and languages and is highly customizable, making it suitable for research and development purposes.

By leveraging these open-source solutions, developers can create innovative applications that harness the power of TTS technology while contributing to the broader AI community.

In summary, AI Text-to-Speech technology is a fascinating field that combines linguistics, computer science, and artificial intelligence. Its applications are diverse, ranging from accessibility tools to content creation and entertainment. As the technology continues to evolve, the potential for new and exciting uses is virtually limitless.

Chapter 2

Exploring Free and Open Source TTS Solutions: A Comparative Overview

In the rapidly evolving landscape of artificial intelligence, Text-to-Speech (TTS) technology has emerged as a powerful tool, enabling machines to convert written text into spoken words. This capability is not only essential for accessibility but also enhances user engagement across various applications, from virtual assistants to educational tools. For those interested in harnessing TTS technology without the constraints of proprietary software, free and open-source solutions offer a compelling alternative. In this chapter, we will explore several notable open-source TTS solutions, comparing their features, usability, and potential applications.

What is Open Source?

Before diving into specific solutions, it's crucial to understand what "open source" means. Open-source software is characterized by its publicly accessible source code, allowing anyone to inspect, modify, and distribute the software. This transparency fosters collaboration and innovation, enabling developers to build upon existing technologies. In the context of TTS, open-source solutions provide users with the flexibility to customize the software to meet their specific needs, whether for personal projects or commercial applications.

Notable Open Source TTS Solutions

1. Mozilla TTS

Mozilla TTS is a powerful, community-driven project that aims to provide high-quality TTS capabilities. Built on deep learning techniques, it supports multiple languages and offers a range of voice options. One of its standout features is the ability to create custom voice models, allowing users to generate speech that closely resembles a specific individual's voice.

Example Use Case: A developer could use Mozilla TTS to create a personalized voice assistant that mimics a celebrity or a fictional character, enhancing user engagement in applications like gaming or interactive storytelling.

For more information, visit the Mozilla TTS GitHub page.

2. eSpeak

eSpeak is a compact, open-source software speech synthesizer for English and other languages. It is known for its small size and fast performance, making it suitable for

embedded systems and applications where resources are limited. While eSpeak may not produce the most natural-sounding speech compared to other solutions, its versatility and ease of integration make it a popular choice for developers.

Example Use Case: eSpeak can be integrated into educational software to provide auditory feedback for language learners, helping them improve their pronunciation and comprehension skills.

Explore more about eSpeak on its [official website](#).

3. Festival

Festival is a comprehensive TTS system that offers a range of tools for speech synthesis. It supports multiple languages and provides various voice options, including male and female voices. Festival is particularly known for its flexibility, allowing users to customize the speech output through various parameters.

Example Use Case: Researchers in linguistics could use Festival to analyze speech patterns by generating synthetic speech samples for different phonetic studies.

Learn more about Festival on its [official site](#).

4. Pico TTS

Pico TTS is a lightweight TTS engine developed by SVOX, primarily designed for mobile devices. It is known for its efficiency and low resource consumption, making it ideal for applications where performance is critical. While it may not offer the same level of voice quality as larger systems, its simplicity and ease of use make it a valuable tool for developers.

Example Use Case: Pico TTS can be utilized in mobile applications to provide voice feedback for notifications or alerts, enhancing user experience without draining device resources.

For more details, check out the [Pico TTS GitHub repository](#).

5. Coqui TTS

Coqui TTS is a relatively new entrant in the open-source TTS landscape, emerging from the Mozilla TTS project. It focuses on providing high-quality, neural network-based speech synthesis. Coqui TTS supports multiple languages and offers a user-friendly interface, making it accessible for both developers and non-technical users.

Example Use Case: Content creators can leverage Coqui TTS to generate voiceovers for videos or podcasts, allowing for a more engaging auditory experience without the need for professional voice actors.

Discover more about Coqui TTS on their [official website](#).

Comparing Features and Usability

When evaluating these TTS solutions, several factors come into play, including voice quality, language support, ease of integration, and community support. For instance, while Mozilla TTS and Coqui TTS excel in producing natural-sounding speech, eSpeak and Pico TTS are more suited for lightweight applications. Festival stands out for its flexibility, making it a go-to choice for researchers and developers looking to customize their TTS experience.

In terms of usability, solutions like Coqui TTS offer user-friendly interfaces that cater to those who may not have extensive technical backgrounds, while others like eSpeak and Festival may require more technical know-how for effective implementation.

Practical Applications

The applications of open-source TTS solutions are vast and varied. From enhancing accessibility for visually impaired users to creating engaging educational tools, the potential is limited only by one's creativity. Developers can integrate these solutions into websites, mobile apps, and even hardware projects, making TTS a versatile component in the AI toolkit.

As we continue to explore the world of free and fully open-source AI TTS solutions, it becomes clear that these technologies not only democratize access to advanced speech synthesis but also empower users to innovate and create in ways that were previously unimaginable.

Chapter 3

Setting Up Your Environment: Installation and Configuration of TTS Tools

In the realm of artificial intelligence, Text-to-Speech (TTS) technology has gained significant traction, enabling applications that range from accessibility tools to interactive voice assistants. For those eager to dive into the world of TTS, setting up your environment is the first crucial step. This chapter will guide you through the installation and configuration of free and fully open-source TTS tools, ensuring you have a solid foundation to build upon.

Understanding TTS Tools

Before we delve into the installation process, let's clarify what TTS tools are. Text-to-Speech tools convert written text into spoken words using synthetic voices. These tools can be incredibly useful for various applications, including reading assistance for the visually impaired, voiceovers for videos, and even creating interactive chatbots. Popular open-source TTS solutions include Mozilla's TTS, Festival, and eSpeak, each with its unique features and capabilities.

Prerequisites for Installation

Before installing any TTS tool, ensure that your system meets the necessary prerequisites. Most TTS tools require:

1. **Operating System**: Most open-source TTS tools are compatible with Linux, Windows, and macOS. However, Linux is often preferred for its flexibility and ease of installation for developers.
2. **Python**: Many TTS tools are built using Python, a versatile programming language. Ensure you have Python installed on your system. You can download it from python.org.
3. **Git**: This version control system is essential for cloning repositories from platforms like GitHub. Install Git from [git-scm.com](git-scm.com).

Installing Mozilla TTS

One of the most popular open-source TTS solutions is Mozilla TTS. It offers high-quality voice synthesis and supports multiple languages. Here's how to install it:

1. **Clone the Repository**: Open your terminal and run the following command to clone the Mozilla TTS repository:
   `git clone https://github.com/mozilla/TTS.git`
2. **Navigate to the Directory**: Change into the TTS directory:

```
cd TTS
```

3. **Install Dependencies**: Mozilla TTS requires several Python packages. You can install them using pip, Python's package installer. Run:

```
pip install -r requirements.txt
```

4. **Download Pre-trained Models**: To get started quickly, you can use pre-trained models. Mozilla provides several models that you can download. For example, to download the English model, run:

```
wget
https://github.com/mozilla/TTS/releases/download/your_model_path/model.pth
```
Replace `your_model_path` with the actual path to the model you wish to download.

5. **Run the TTS**: Finally, you can test the installation by running a simple command to convert text to speech:

```
python TTS/bin/synthesize.py --text "Hello, welcome to the world of
Text-to-Speech!" --model_path model.pth
```

Configuring Festival TTS

Another robust option is Festival, a general multi-lingual speech synthesis system. Here's how to set it up:

1. **Install Festival**: On Ubuntu, you can install Festival using:

```
sudo apt-get install festival
```

2. **Run Festival**: After installation, you can start Festival by simply typing:

```
festival
```

3. **Synthesize Speech**: To convert text to speech, you can use the following command within the Festival shell:

```
(SayText "Hello, this is Festival speaking!")
```

Festival also supports various voices and languages, which can be configured through its settings.

Exploring eSpeak

eSpeak is another lightweight and versatile TTS engine that supports a wide range of languages. Here's how to install and use it:

1. **Install eSpeak**: On Ubuntu, you can install eSpeak with:

```
sudo apt-get install espeak
```

2. **Synthesize Speech**: You can quickly convert text to speech by running:

```
espeak "Hello, this is eSpeak speaking!"
```

eSpeak is particularly useful for applications where a small footprint is essential, such as embedded systems.

Additional Configuration

After installing your chosen TTS tool, you may want to explore additional configurations to enhance your experience. For instance, you can adjust the voice parameters, such as pitch and speed, to create a more personalized output. Each TTS tool has its own set of configuration options, which can usually be found in the documentation or help files.

For more advanced users, integrating TTS with other technologies, such as web applications or chatbots, can open up exciting possibilities. For example, you can use Flask, a lightweight web framework for Python, to create a web interface that allows users to input text and receive audio output in real-time.

Resources for Further Learning

To deepen your understanding of TTS technologies and their applications, consider exploring the following resources:

- Mozilla TTS Documentation
- Festival Documentation
- eSpeak Documentation

By setting up your environment with these tools, you are well on your way to harnessing the power of Text-to-Speech technology. Whether you're developing applications for accessibility, creating engaging content, or simply experimenting with voice synthesis, the possibilities are vast and exciting.

Chapter 4 - Creating Engaging Audio Content: Practical Examples and Use Cases

In the realm of digital content, audio has emerged as a powerful medium for communication and storytelling. With the rise of free and fully open-source AI text-to-speech (TTS) solutions, creating engaging audio content has never been more accessible. This chapter explores practical examples and use cases that illustrate how you can leverage these technologies to captivate your audience.

Understanding Text-to-Speech Technology

Text-to-speech technology converts written text into spoken words using artificial intelligence. This process involves several steps, including text analysis, linguistic processing, and voice synthesis. The result is a natural-sounding voice that can read aloud any text input. Open-source TTS solutions, such as Mozilla's TTS and eSpeak, allow users to customize and implement these technologies without the constraints of proprietary software.

Example: Audiobooks and Podcasts

One of the most popular applications of TTS technology is in the creation of audiobooks and podcasts. Imagine you have a blog filled with insightful articles on cryptocurrency and web development. By using an open-source TTS solution, you can convert these articles into audio format, allowing your audience to listen while commuting or multitasking.

For instance, if you have an article titled "The Future of Cryptocurrency," you can use Mozilla's TTS to generate an audio version. This not only broadens your audience but also enhances user engagement, as many people prefer consuming content through audio rather than reading.

Use Case: Educational Content

In the field of education, TTS can be a game-changer. Consider a scenario where you are developing an online course on AI and image generation. By integrating TTS technology, you can create audio lectures that accompany your written materials. This caters to different learning styles, as some students may absorb information better through listening.

For example, platforms like OpenAI's Whisper can be utilized to generate audio explanations of complex concepts, such as neural networks or generative adversarial

networks (GANs). By providing audio content, you can make your educational resources more inclusive and accessible to a wider audience.

Engaging Storytelling

Another exciting application of TTS is in storytelling. Whether you are creating a fictional narrative or sharing personal experiences, audio can add a new dimension to your storytelling. By using expressive voices and varying intonations, you can evoke emotions and keep your listeners engaged.

Imagine creating an audio series that explores the intersection of AI and adult content. By using an open-source TTS solution, you can narrate stories that delve into ethical considerations, technological advancements, and societal impacts. This not only informs your audience but also sparks discussions on platforms like Reddit, where users can share their thoughts and opinions.

Interactive Applications

TTS technology can also be integrated into interactive applications, enhancing user experience. For instance, if you are developing a web application that provides cryptocurrency market analysis, you can implement TTS to read out market trends and predictions. This feature can be particularly useful for users who prefer auditory information while analyzing data.

By incorporating TTS into your application, you can create a more dynamic and engaging interface. Users can listen to updates while they navigate through charts and graphs, making the experience more seamless and informative.

Accessibility Considerations

Creating engaging audio content also involves considering accessibility. TTS technology can significantly benefit individuals with visual impairments or reading difficulties. By providing audio versions of your content, you ensure that everyone has the opportunity to access and enjoy your work.

For example, if you run a website focused on web development tutorials, offering audio explanations can help visually impaired users understand complex coding concepts. This commitment to inclusivity not only broadens your audience but also fosters a sense of community.

Conclusion

As we explore the potential of free and fully open-source AI text-to-speech solutions, it becomes clear that the possibilities for creating engaging audio content are vast. From audiobooks and educational resources to interactive applications and storytelling, TTS technology can transform the way we communicate and share information. By embracing these tools, you can captivate your audience and enhance their experience, making your content more accessible and enjoyable.

For more information on open-source TTS solutions, check out Mozilla's TTS and eSpeak.

Chapter 5

Current Trends and Developments in Open Source TTS Technology

In recent years, the landscape of Text-to-Speech (TTS) technology has undergone significant transformation, particularly within the realm of open-source solutions. Open-source TTS systems are not only democratizing access to voice synthesis technology but also fostering innovation through community collaboration. This chapter delves into the current trends and developments in open-source TTS technology, highlighting key projects, advancements, and their implications for various applications.

The Rise of Neural TTS

One of the most notable trends in TTS technology is the shift from traditional concatenative and rule-based synthesis methods to neural network-based approaches. Neural TTS systems leverage deep learning techniques to produce more natural and expressive speech. For instance, projects like Mozilla's TTS utilize deep learning models to generate high-quality, human-like speech. This project has gained traction due to its ability to produce diverse voice outputs and its support for multiple languages, making it a versatile tool for developers and researchers alike.

Neural TTS systems work by training on large datasets of recorded speech, allowing them to learn the nuances of human voice, including intonation, pitch, and rhythm. This results in a more fluid and engaging listening experience compared to earlier TTS technologies, which often sounded robotic and monotonous. For example, the use of models like Tacotron 2 and FastSpeech has shown remarkable improvements in the naturalness of synthesized speech, making them suitable for applications ranging from audiobooks to virtual assistants.

Voice Cloning and Customization

Another exciting development in open-source TTS is the emergence of voice cloning technologies. Projects like Coqui TTS enable users to create custom voice models based on a limited amount of audio data. This capability is particularly appealing for content creators and businesses looking to maintain a consistent brand voice across various media. By simply providing a few minutes of recorded speech, users can generate a unique voice that reflects their personality or brand identity.

Voice cloning raises interesting ethical considerations, especially in the context of adult content and other sensitive applications. As the technology becomes more accessible, it is crucial for developers and users to navigate the ethical implications responsibly, ensuring that voice cloning is used in ways that respect privacy and consent. For instance, the ability to clone a voice for use in a video game or a virtual assistant can

enhance user engagement, but it also necessitates clear guidelines to prevent misuse.

Multilingual Support and Accessibility

Open-source TTS projects are increasingly focusing on multilingual support, making them more inclusive and accessible to a global audience. For example, eSpeak NG is an open-source TTS engine that supports a wide range of languages and dialects. This is particularly important in educational contexts, where diverse language support can enhance learning experiences for non-native speakers.

Moreover, the push for accessibility in technology has led to the development of TTS solutions that cater to individuals with disabilities. By providing high-quality speech synthesis, open-source TTS can help bridge communication gaps for those with visual impairments or reading difficulties. Projects like Festival have been instrumental in promoting accessibility through their robust TTS capabilities. For instance, educational institutions can utilize these technologies to create audiobooks or reading aids, making learning materials more accessible to students with disabilities.

Integration with Other Technologies

The integration of open-source TTS with other technologies is another trend worth noting. For instance, TTS systems are increasingly being combined with natural language processing (NLP) and machine learning algorithms to create more interactive and responsive applications. This synergy is evident in projects like OpenAI's Whisper, which combines speech recognition and synthesis to facilitate seamless communication between humans and machines.

Such integrations are particularly relevant in web development, where TTS can enhance user experience by providing audio feedback or narration for web applications. Developers can leverage APIs from open-source TTS projects to incorporate voice synthesis into their applications, making them more engaging and user-friendly. For example, integrating TTS into e-learning platforms can provide auditory feedback for quizzes or reading materials, enhancing the overall learning experience.

Community-Driven Innovation

The open-source nature of these TTS projects fosters a collaborative environment where developers, researchers, and enthusiasts can contribute to ongoing improvements. Community-driven initiatives often lead to rapid advancements and the sharing of best practices. For example, the OpenTTS project aims to unify various TTS engines under a single framework, allowing users to easily switch between different synthesis engines based on their needs.

This collaborative spirit not only accelerates technological advancements but also ensures that the solutions developed are more robust and versatile. As more contributors join these projects, the potential for innovation expands, leading to new features and capabilities that can benefit a wide range of applications. For instance,

community contributions have led to the development of specialized voices for different contexts, such as educational materials or entertainment.

Conclusion

The current trends and developments in open-source TTS technology reflect a dynamic and rapidly evolving field. With advancements in neural synthesis, voice cloning, multilingual support, and integration with other technologies, open-source TTS solutions are becoming increasingly powerful and accessible. As these technologies continue to mature, they hold the potential to transform how we interact with machines, making communication more natural and intuitive. The collaborative nature of open-source projects ensures that innovation will persist, paving the way for even more exciting developments in the future.

Chapter 6

Navigating Legal and Ethical Considerations in AI TTS Applications

As artificial intelligence (AI) continues to evolve, particularly in the realm of Text-to-Speech (TTS) applications, it becomes increasingly important to navigate the legal and ethical considerations that accompany these technologies. This chapter aims to provide a comprehensive overview of the key issues surrounding AI TTS applications, ensuring that developers and users alike can engage with these tools responsibly and effectively.

Understanding Intellectual Property Rights

One of the foremost legal considerations in AI TTS applications is intellectual property (IP) rights. Intellectual property refers to creations of the mind, such as inventions, literary and artistic works, designs, symbols, names, and images used in commerce. In the context of TTS, this can include the voice models used to generate speech, the underlying algorithms, and even the text being converted to speech.

For instance, if a developer creates a TTS application that uses a proprietary voice model, they must ensure that they have the right to use that model. This often involves licensing agreements with the creators of the voice or the underlying technology. Failure to secure these rights can lead to legal disputes and potential financial penalties. A practical example is the case of voice cloning technology, where companies like Descript have faced scrutiny over the use of celebrity voices without consent.

Copyright and Fair Use

Copyright law plays a significant role in the use of text in TTS applications. When using copyrighted material, such as books, articles, or scripts, developers must consider whether their use falls under the doctrine of "fair use." Fair use allows for limited use of copyrighted material without permission from the rights holder, typically for purposes such as criticism, comment, news reporting, teaching, scholarship, or research.

For example, if a TTS application is used to create an educational tool that reads excerpts from a copyrighted textbook, it may qualify as fair use if it is transformative and does not negatively impact the market for the original work. However, the boundaries of fair use can be murky, and developers should consult legal experts when in doubt.

Data Privacy and User Consent

Another critical aspect of legal and ethical considerations in AI TTS applications is data privacy. With the increasing use of AI technologies, concerns about how user data is

collected, stored, and utilized have come to the forefront. Developers must ensure that they comply with data protection regulations, such as the General Data Protection Regulation (GDPR) in Europe or the California Consumer Privacy Act (CCPA) in the United States.

For instance, if a TTS application collects user data to improve its algorithms, it must obtain explicit consent from users. This means clearly informing users about what data is being collected, how it will be used, and providing them with the option to opt-out. Failure to adhere to these regulations can result in hefty fines and damage to a company's reputation.

Ethical Considerations in Voice Synthesis

Beyond legal obligations, ethical considerations also play a crucial role in the development and deployment of AI TTS applications. One significant ethical concern is the potential for misuse of voice synthesis technology. For example, deepfake technology, which can create realistic audio and video of individuals saying things they never actually said, poses risks for misinformation and defamation.

Developers must be vigilant in implementing safeguards to prevent the misuse of their TTS applications. This could include watermarking synthesized voices or creating usage guidelines that prohibit malicious applications. Additionally, transparency about the capabilities and limitations of TTS technology can help mitigate ethical concerns. For instance, informing users that a voice is synthesized rather than a real person can help prevent deception.

Accessibility and Inclusivity

AI TTS applications also have the potential to enhance accessibility for individuals with disabilities. By providing spoken versions of written content, TTS technology can help those with visual impairments or reading difficulties access information more easily. However, developers must ensure that their applications are designed with inclusivity in mind.

This includes considering the diversity of voices available in TTS applications. Offering a range of voice options that reflect different accents, genders, and age groups can make the technology more relatable and effective for a broader audience. For example, Google's TTS system includes multiple voice options that cater to various user preferences, enhancing the overall user experience.

Conclusion

Navigating the legal and ethical landscape of AI TTS applications is a multifaceted endeavor that requires careful consideration of intellectual property rights, data privacy, ethical implications, and accessibility. By understanding these issues, developers can create TTS solutions that not only comply with legal standards but also promote ethical use and inclusivity. As the technology continues to advance, ongoing dialogue and

education around these topics will be essential for fostering a responsible AI ecosystem.

For further reading on legal considerations in AI, you can explore resources such as the Electronic Frontier Foundation and Creative Commons.