

Three-way Decision In GANs

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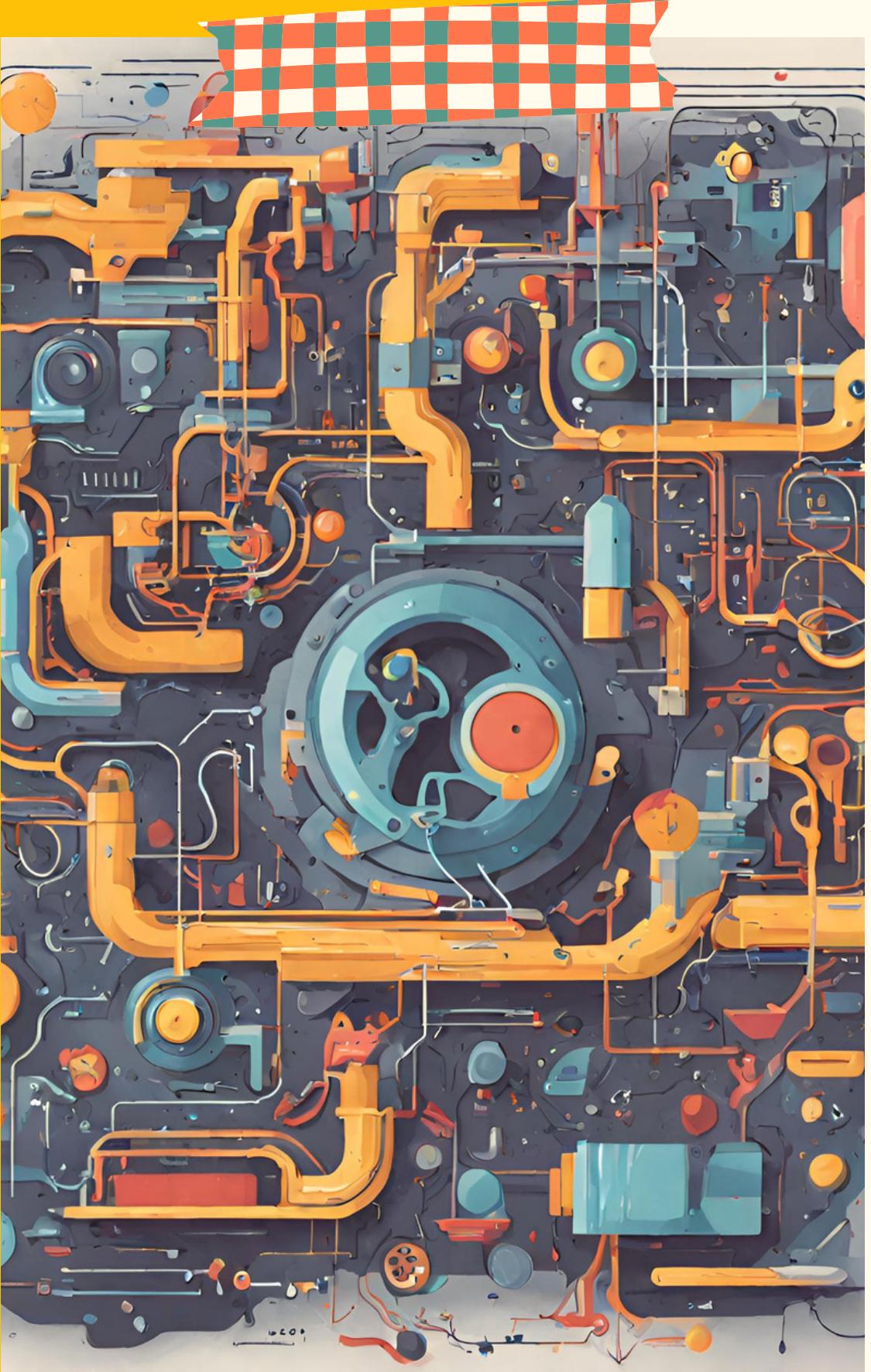
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Project ABSTRACT

Short Brief

Presentation delves into the integration of three-way decision-making into Generative Adversarial Networks (GANs).

1. Three-Way Decision Concept: Divides choices into three categories, aligning with human cognitive processes.
2. Proposed GAN Model: Emphasizes realism, diversity, and novelty.
3. Methodology: Synthesizing insights from 52 papers through systematic literature review methodologies.
4. Anticipated Benefits: Heightened diversity, adaptive learning, and improved explainability in GANs.
5. Interdisciplinary Nature: The work extends its applicability, promising innovative advancements in GAN research.



What is Three-way decision:

Definition: Three-way decision involves dividing a whole into three parts or regions and formulating strategies or actions for each division.

It is Widely applied in cognitive computing, artificial intelligence, and problem-solving across various fields.

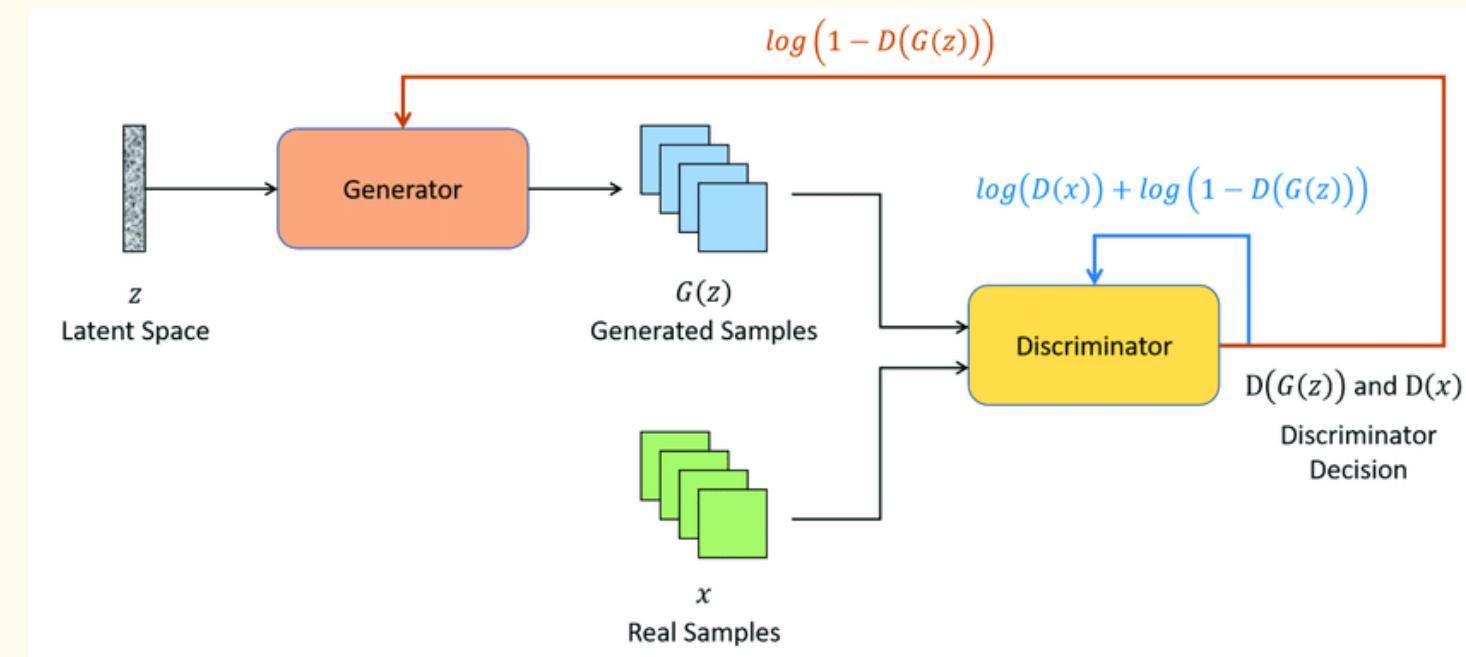
It is Rooted in the recognition of the human cognitive capacity to process information effectively in threes.

The three-way decision serves as a conceptual framework leveraging the cognitive capacity for processing information in threes.

It Offers advantages such as reduced cognitive load and cognitive simplicity.

How GAN works

- Origin: Introduced by Ian Goodfellow in 2014.
- Architecture: Consists of a generator and a discriminator trained simultaneously through adversarial training.
- Adversarial Training: The generator aims to fool the discriminator, while the discriminator enhances its ability to distinguish between real and fake data.



Data Collection

1. Total Papers Studied: 52

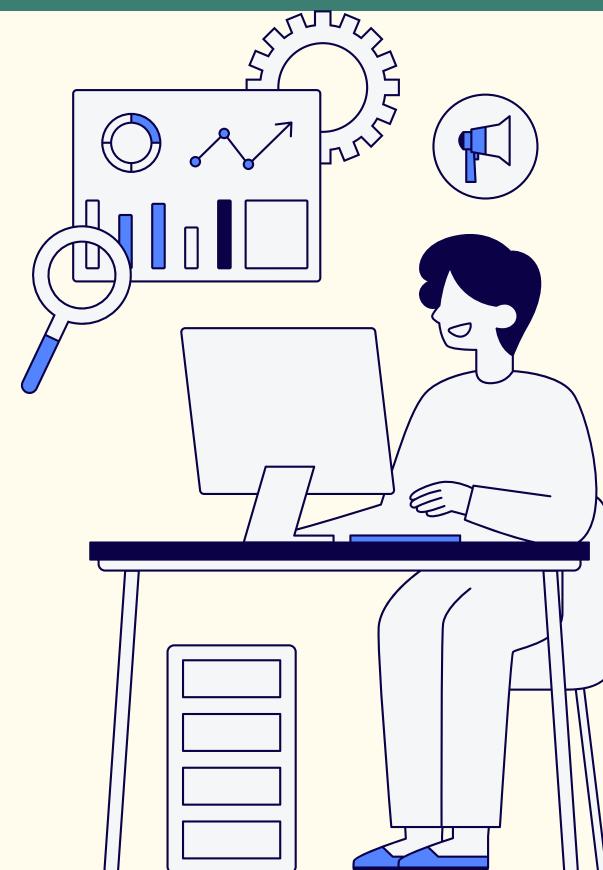
2. Paper Selection Criteria: Inclusion criteria focused on papers exploring the intersection of three-way decisions and cognitive computing within the context of Generative Adversarial Networks (GANs).

3. Interdisciplinary Nature: Papers drawn from interdisciplinary domains like cognitive psychology, computer science, philosophy, literature, and artificial intelligence for a holistic analysis.

This comprehensive data collection process ensures a robust foundation for the insights presented in the subsequent slides.



Data Analysis



Exploration of the intersection between three-way decisions, cognitive computing, and Generative Adversarial Networks (GANs).

Key Themes Across Papers:

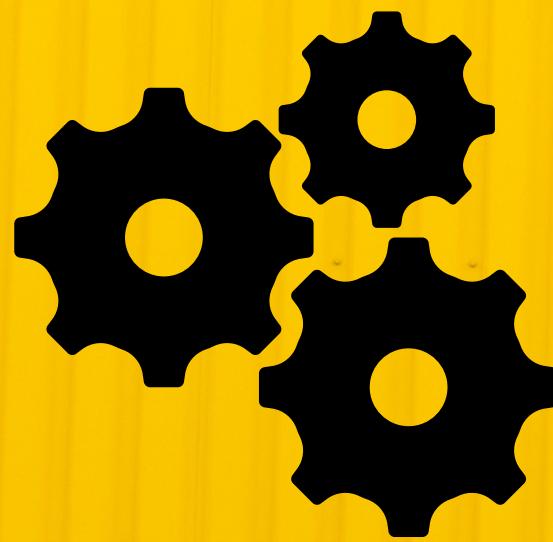
- 1. Frameworks :** Trisecting-and-acting model aligns with GANs, viewing the generator and discriminator as trisecting components, highlighting the structured approach.
- 2. Applications :** Cognitive advantages of three-way decisions resonate in GANs, showcasing relevance in training and application for realistic data generation.
- 3. Research Issues :** Identifies research issues aligning with GAN challenges like mode collapse, emphasizing the need for effective trisecting strategies.

Data Analysis

Continuation of Key Themes:

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- 5. Geometric and Philosophical Dimensions : Explores geometric structures and philosophical dimensions, offering insights into aesthetic considerations and ethical development of GANs.
 - 6. Explainable AI : Aligns with the demand for interpretability in GANs, suggesting integration of triadic structures for enhanced explainability.
 - 7. Three-Way Decision in Literature : Literary exploration of three-way decisions provides a creative lens for understanding diverse styles or genres in GAN-generated content.
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How GAN works using three way decision



- Trisecting-Acting-Outcome (TAO) Model for GANs:
 1. Trisecting:
 - Real Samples: Category for real samples from the training dataset.
 - Generated Samples: Category for samples produced by the GAN's generator.
 - Novelty or Diversity: Introduce a third category for novel or diverse samples.
 2. Acting:
 - Discriminator's Role: Assesses samples in all three categories, providing feedback on real, generated, or novel.
 - Generator's Objective: Aims to produce realistic samples and explore novel variations to avoid predictability.



How GAN works using three way decision



3. Outcome Evaluation:

- Adversarial Training: Adjusts generator and discriminator based on performance in the three categories.

- Balancing Realism and Novelty: Seeks a balance between realism and novelty in generated samples.

• Potential Advantages:

1. Reduced Mode Collapse

2. Adaptive Learning

3. Improved Robustness



Traditional GAN VS The Proposed Model:

Aspect	Traditional GAN	Proposed Model
Decision Categories	Real vs. Generated	Real vs. Generated vs. Novelty/Diversity
Discriminator's Role	Differentiates between real and generated	Assesses samples in all three categories
Generator's Objective	Produces more realistic samples	Aims for realism and explores novel variations
Potential Advantages	Standard GAN operation & Adversarial training	Enhanced diversity, Adaptive learning & Improved robustness
Conclusion	Traditional GAN operation with binary decision	Three-way decision model with added complexity

Application of Three-Way Decision in GAN

- GANs traditionally involve binary decisions (real or fake) in training.
- Applying the three-way decision concept could introduce an additional category, adding complexity to the training process.

1.Three-Way Decision in GAN Training:

- Adapt the trisecting-acting-outcome (TAO) model for GANs.

2.Improving Training Stability:

- Address challenges like mode collapse and training instability.

3.Granular Computing for Image Synthesis:

- Apply structured approaches to information processing in GANs.
- Break down the generation process into granules or levels, representing features, resolutions, or styles.



Application of Three-Way Decision in GAN

4. Explainable AI in GANs:

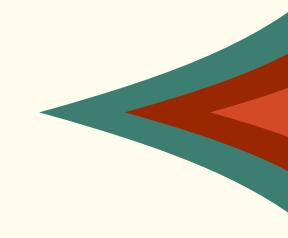
- o Utilize concepts from Three-Way Decision and Explainable AI.**

5. Applying Three-World Conception to GAN Outputs:

- o Categorize GAN outputs into different realms: generator's world, discriminator's world, and real world.**



Future Scopes for Three-Way Decision in GANs & Considerations



The integration of three-way decision models in Generative Adversarial Networks (GANs) opens avenues for improvement and innovation & some Considerations too.

- Enhanced Diversity and Realism:
 - Develop sophisticated algorithms for generating novel variations while maintaining high-quality outputs.
- Adaptive Learning Strategies:
 - Investigate adaptive learning strategies within the three-way decision framework.
 - Develop mechanisms for dynamic adjustments based on feedback from the discriminator.
- Dynamic Trisecting Methods:
 - Explore adaptive sample categorization during training.
 - Implement mechanisms for recognizing and adjusting trisecting strategy based on category emphasis or underrepresentation.
- Hardware Acceleration:
 - Consider hardware-accelerated solutions to mitigate computational costs.
 - Leverage specialized hardware or optimize algorithms for efficient parallel processing.

References

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Conclusion

Embarking on the frontier of innovation, the marriage of three-way decision models with the dynamic realm of Generative Adversarial Networks (GANs) emerges as a beacon of promise, illuminating the path forward for the next epoch of generative models. The proposed trisecting-acting-outcome (TAO) model offers a structured approach, balancing realism, diversity, and novelty. This interdisciplinary approach holds significant potential for the evolution of GANs and contributes to a deeper understanding of human-like decision-making in artificial intelligence.



Thank you!

Any Questions ?

