Continuously Augmented Discrete Diffusion Model for Categorical Generative Modeling

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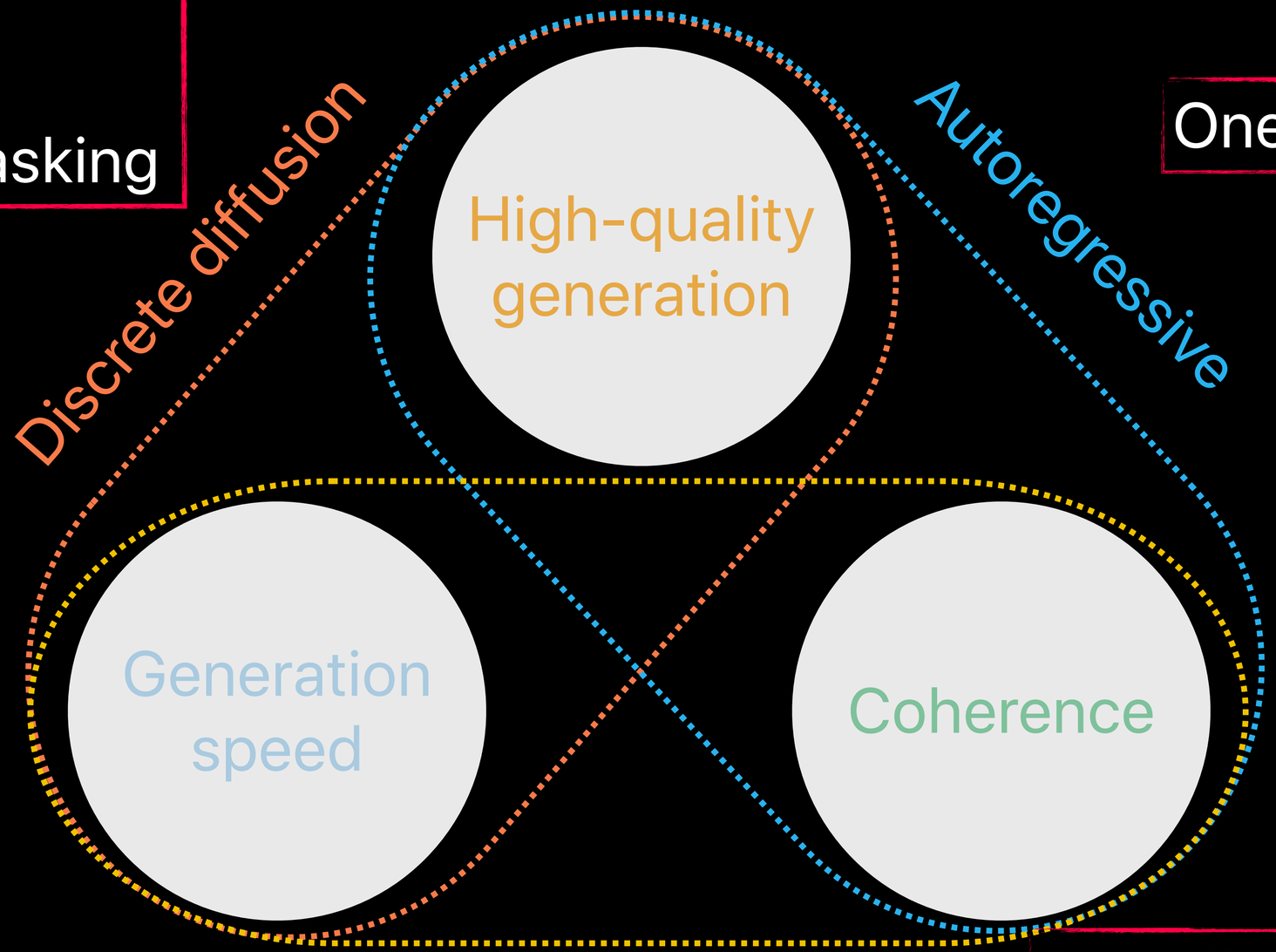
Trilemma of Generative Modeling

No regrets

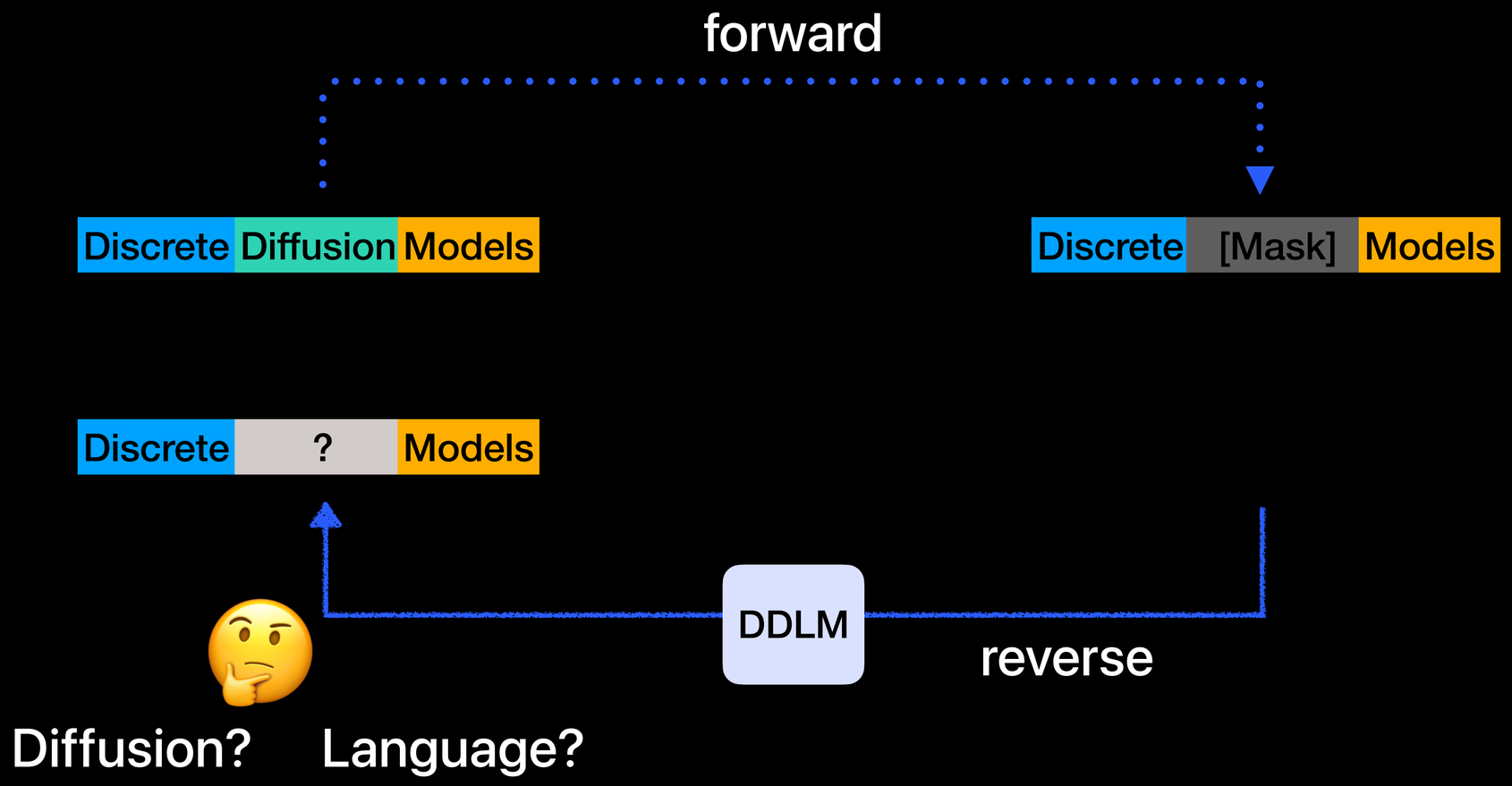
Random masking



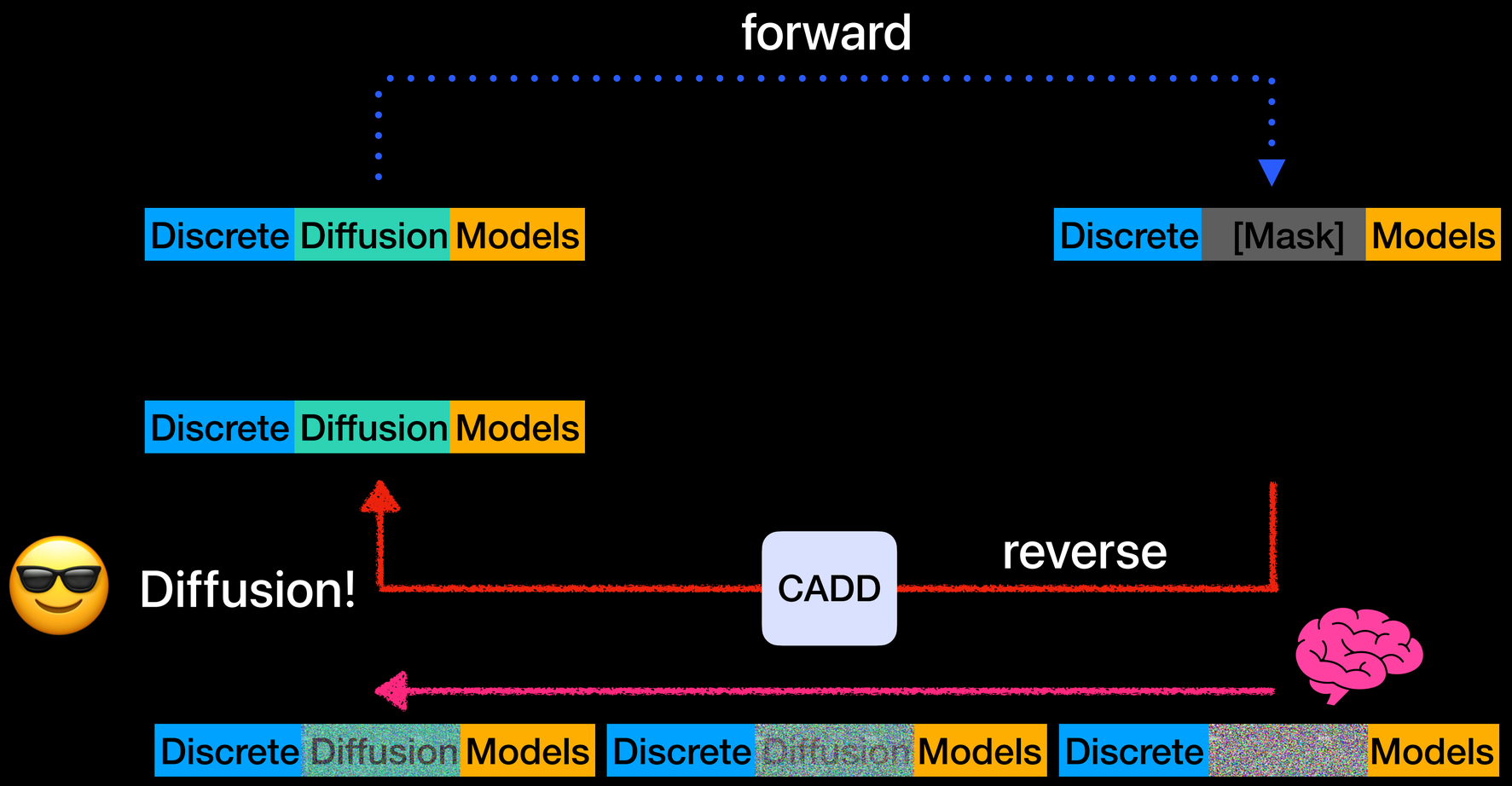
One token per step

Rounding error

The information “void” from [MASK]



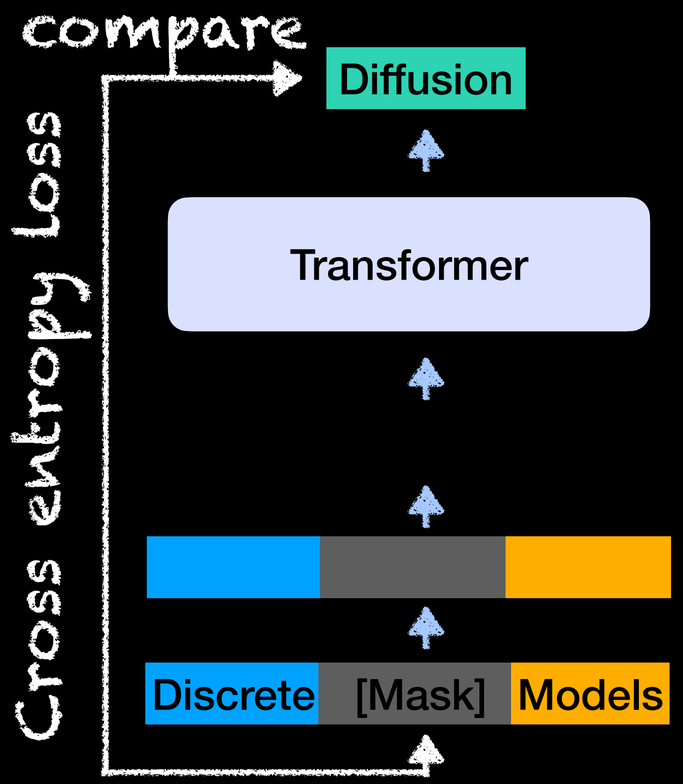
Avoid the information “void” from [MASK]



Training as simple as previous models

No architecture modification: compatible with LLMs, dLLMs, DMs

Recover the complete target: multiple latents jointly decide prediction



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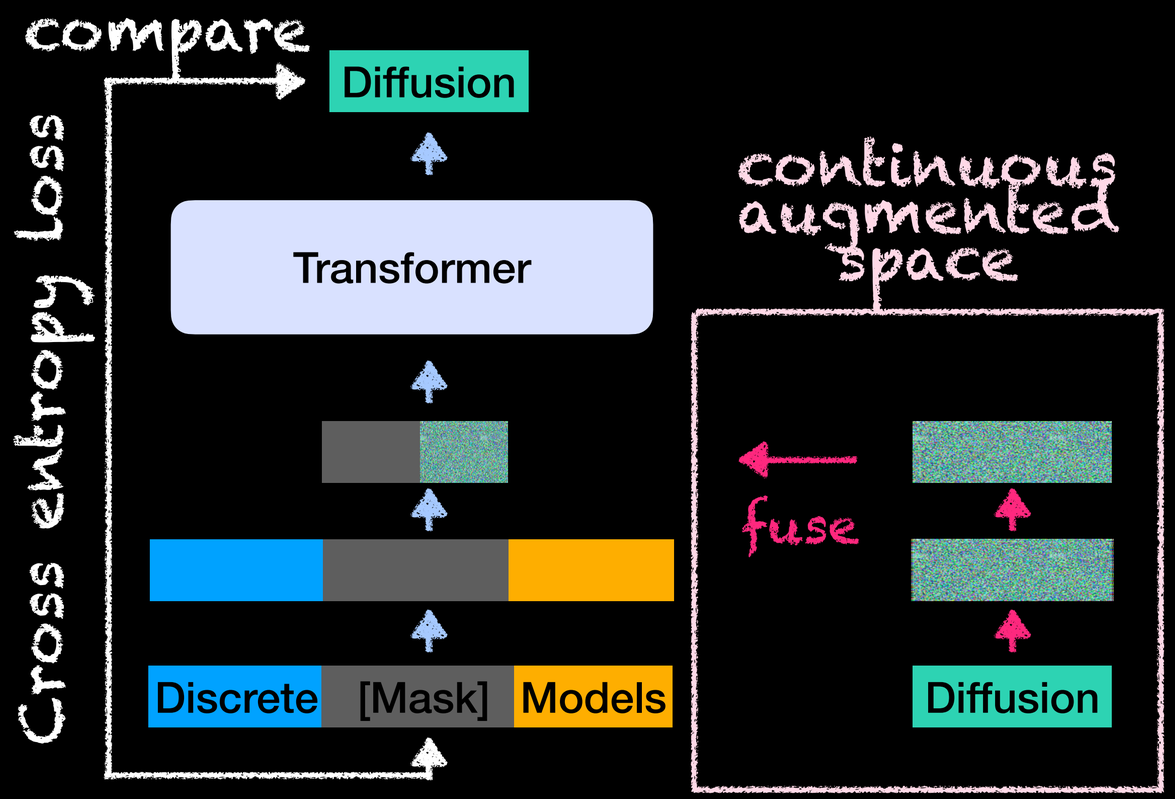


data x_0 , token embedding $\mathbf{E}$, transformer f_θ

$x_t \leftarrow x_0$ adding mask

$z_t \leftarrow \mathbf{E}(x_t)$ lookup embeddings

$z_0 \leftarrow \mathbf{E}(x_0)$ copy of clean embed

$z_t \leftarrow z_t + (z_0 + t\epsilon_t)$ fusion

$\hat{x}_0 \leftarrow f_\theta(z_t)$ predict

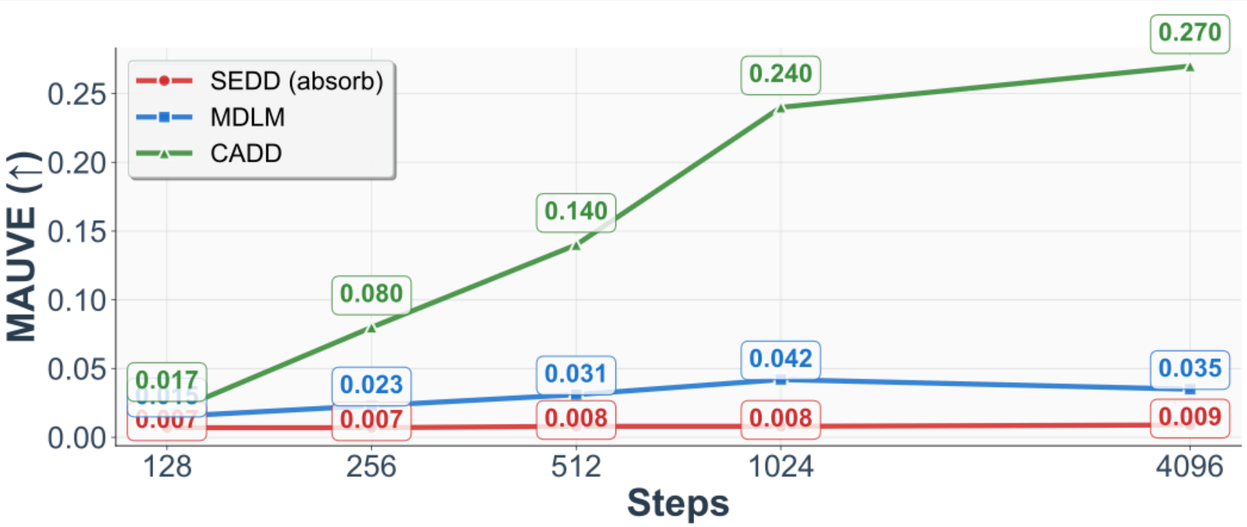
compute loss $\mathscr{L}(\hat{x}_0, x_0)$

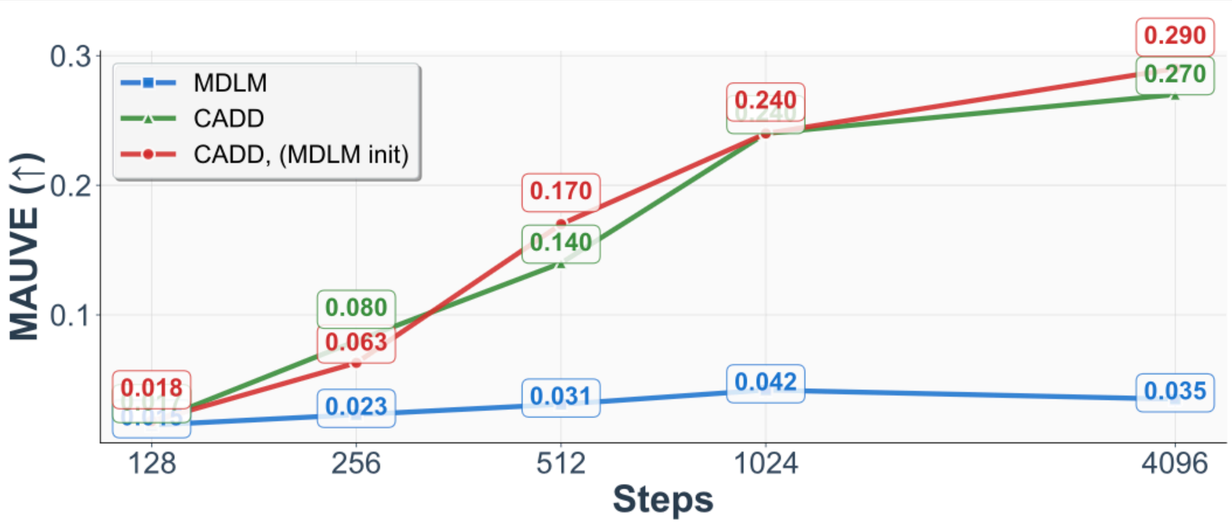
CADD for text generation

Generating a sequence with 1024 tokens

- testing-time scaling: more steps better performance
- thinking more: steps > tokens
- finetuning: boost existing models

```
Empirical result removes the connection with the subjective difference in
intuitive balance, so the constraint on consciousness creates a reversal
of psychic fluctuations, but it is contrasted with this effect. In fact,
as a result, that is no longer the intuitive result, but rather the
temporal result. Similar phenomena exists even for consciousness, with
the relative difference in the difference between subjective differences
as explicit combinations of conscious consciousness.
The rational result holds that then the ability to create potential
psychic momentum into the subjective matter involved in intuitive
addition should be limited, but this result is not a true illusion. The
acceleration of verbal stimulus means be well mediated, while the
temporal effect does not necessary given that the concentration of
rational momentum in actual temporal momentum was more important, while
the indirect relation was very apparent, that is not necessarily the
normal condition. This does not seem to explain directly if the
accumulation of symbolic differences in conscious momentum, which
resulted in the accumulation of confidence in the past, would explain
some reason for only adding the intuitive transition, but to be confused
with the conscious difference...
```





CADD for image generation

Direct pixel generation

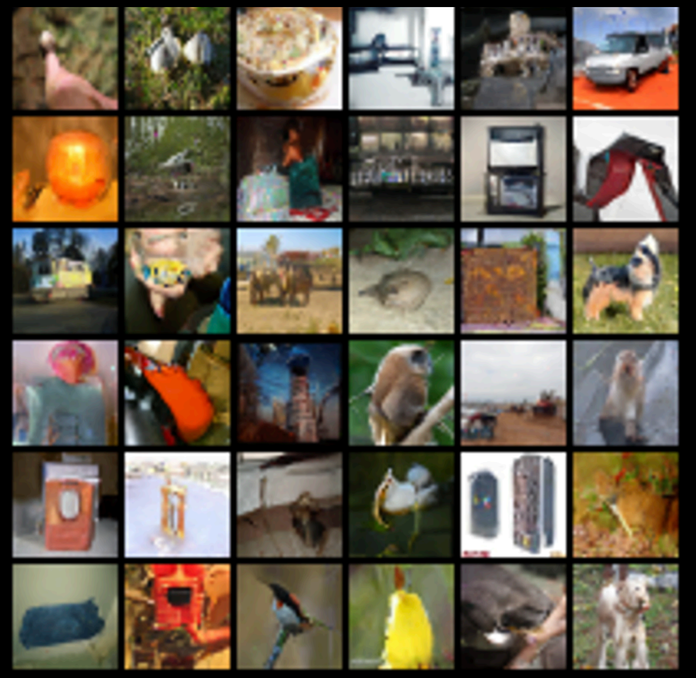
- better performance against D/C DMs
- more options in guidance

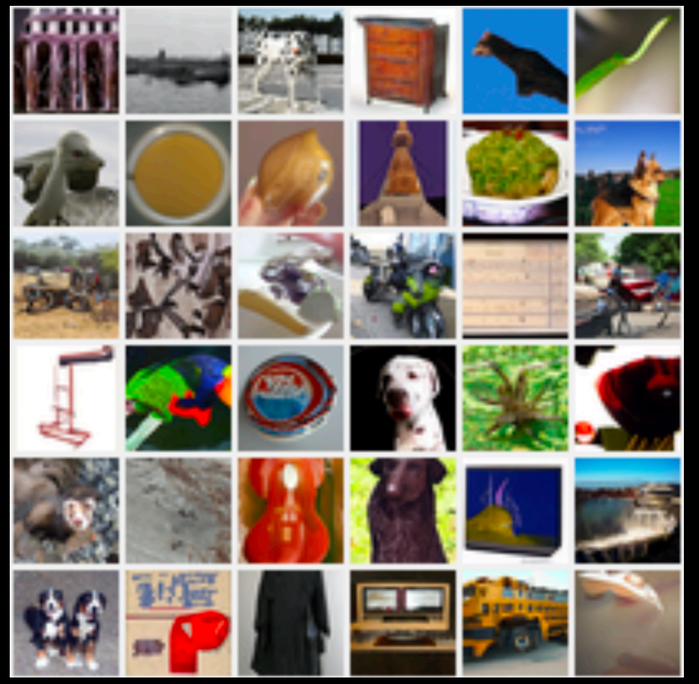
Table 1 FID and IS evaluation on CIFAR-10. The arrow symbols denote lower/higher is better respectively. Baseline results are quoted from Chao et al. (2025).

Method	FID (↓)	IS (↑)
CADD (NFE=512)	**2.88**	**10.04**
Discrete		
MDM (NFE=512)	4.66	9.09
MDM-Mixture (NFE=512)	4.80	9.22
MDM-Prime (NFE=512)	3.26	9.67
D3PM Absorb (NFE=1,000)	30.97	6.78
D3PM Gauss. (NFE=1,000)	7.34	8.56
CTDD-DG (NFE=1,000)	7.86	8.91
Tau-LDR (NFE=1,000)	3.74	9.49
Discrete FM (NFE=1,024)	3.63	-
Continuous		
Continuous FM	6.35	-
Bit Diffusion	3.48	-
StyleGAN+ADA	3.26	9.74
DDPM	3.17	9.46

Table 2 FID evaluation using model unconditionally trained on ImageNet (32×32 resolution).

Method	FID (↓)
CADD (NFE=1,024)	**3.74**
Discrete	
MDM (NFE=1,024)	7.91
MDM-Mixture (NFE=1,024)	8.08
MDM-Prime (NFE=1,024)	6.98
Continuous	
NDM	17.02
DDPM	16.18
MSGAN	12.30
i-DODE (SP)	10.31
i-DODE (VP)	9.09
Stochastic Interp.	8.49
Soft Trunc. DDPM	8.42
ScoreFlow (subVP)	8.87
ScoreFlow (VP)	8.34
Continuous FM	5.02





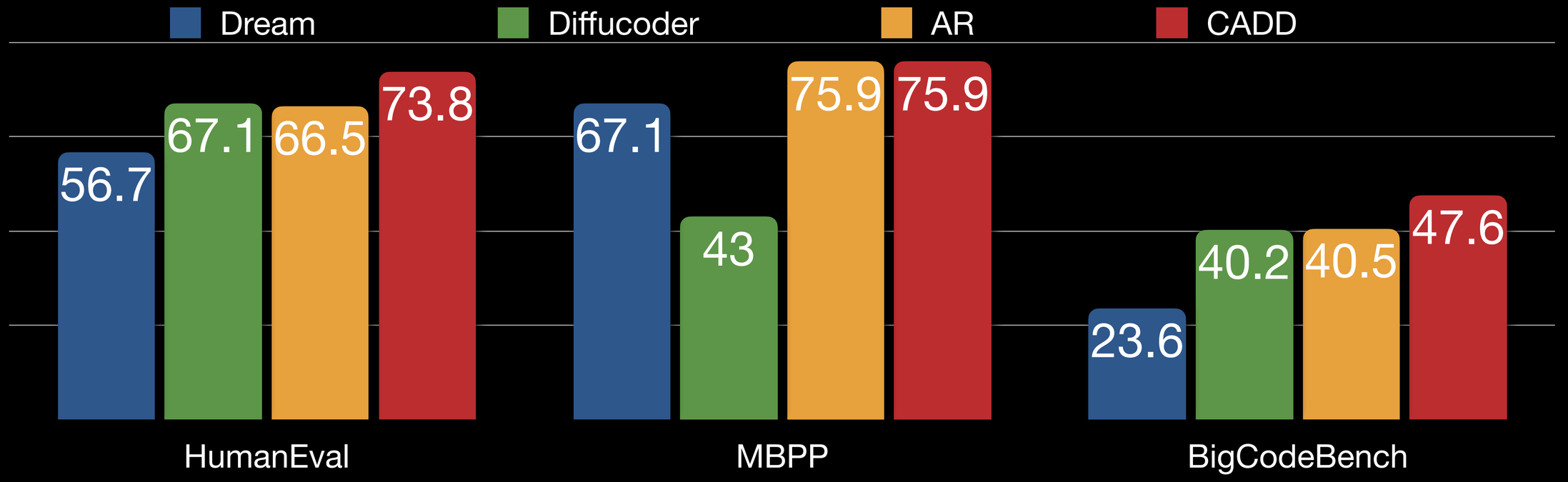
CADD for code generation

Diffucoder pipeline

- better performance against dLLMs and AR baselines

```python
from typing import List

def has_close_elements(numbers: List[float], threshold: float) -> bool:
    """ Check if in given list of numbers, are any two numbers closer to each other than
    given threshold.
    >>> has_close_elements([1.0, 2.0, 3.0], 0.5)
    False
    >>> has_close_elements([1.0, 2.8, 3.0, 4.0, 5.0, 2.0], 0.3)
    True
    """
    for i in range(len(numbers)):
        for j in range(i + 1, len(numbers)):
            if abs(numbers[i] - numbers[j]) < threshold:
                return True
    return False
```



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Friday, Apr 24th 11:15 AM - 1:45 PM PDT