Drawing Math

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1 Introduction

- Numberphile video - I was bored and this looked fun - I wasn't paying attention in one of my lectures... - This paper is purely for funs... for now

2 Background

- Digital math - Euler's formula - I payed attention in some of my lectures

3 Definitions and questions

3.1 Definitions

Say you (yes you!) had a turtle living in D dimensional Euclidean space and in discrete time. At time step i, where $i \in \mathbb{Z}$ and $i > 0$, the turtle has position $p_i \in \mathbb{R}^D$. Then, lets define $\Delta p_{i+1} = p_{i+1} - p_i$; in other words, Δp_{i+1} is the change in position from time i to $i+1$.

Now say that the turtle's movement is determined by k seed parameters drawn from the same set. Then, for some state space $\mathcal{S}$, define $s_i^j \in \mathcal{S}$ to be some arbitrary state associated with timestamp i for the jth seed parameter where $j \in [k]$. Next we will define a set of functions $SU_j : \mathcal{S} \to \mathcal{S}$ (for *S*tate *U*pdater) such that $s_{i+1}^j = SU_j(s_i^j, i)$. Note that for $j, a \in [m]$ where $j \neq a$, s_{i+1}^j is determined solely by s_i^j and i and not s_i^a.

Now that we have our machinery built up, lets define $f^k : \mathcal{S} \to \mathbb{R}$ and $Comb : \mathbb{R}^k \to \mathbb{R}^d$ such that

$$\Delta p_{i+1} = Comb\left(f^1(s_{i+1}^1), f^2(s_{i+1}^2), ..., f^k(s_{i+1}^k)\right).$$

In other words, $Comb$ takes in a real number determined by the state of each seed and returns an update to the position of the turtle.

3.2 Our case

We only consider the case where

$$Comb(x_1, x_2, ..., x_k) = \left(\prod_{i=1}^{k} x_j^{\text{incl}_1^j}, ..., \prod_{i=1}^{k} x_j^{\text{incl}_D^j}\right)$$

where $incl_d^j \in \{0, 1\}$ for $d \in [D]$ indicates whether to include a given $x \in R$ determined by seed j for position update in the dth dimension.

4 Results

[Wat18]

5 Conclusion

6 Open Questions

Acknowledgments

References

[Wat18] John Watrous. *The theory of quantum information*. Cambridge university press, 2018. 4