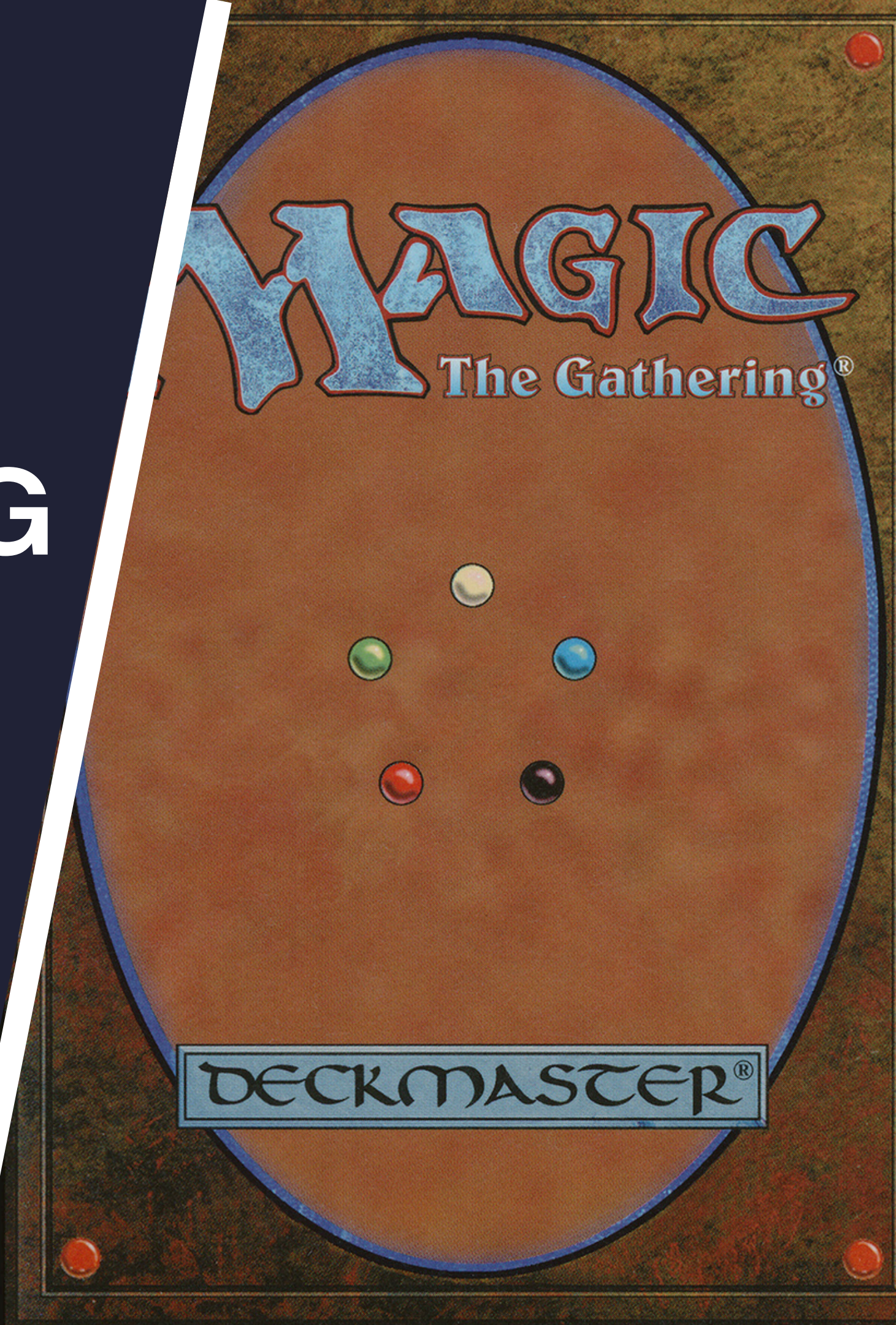
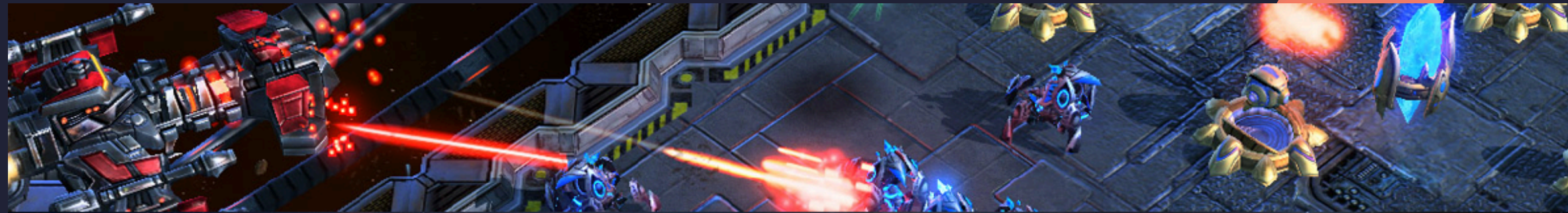


CONTRASTIVE LEARNING FOR IMPERFECT INFORMATION GAMES

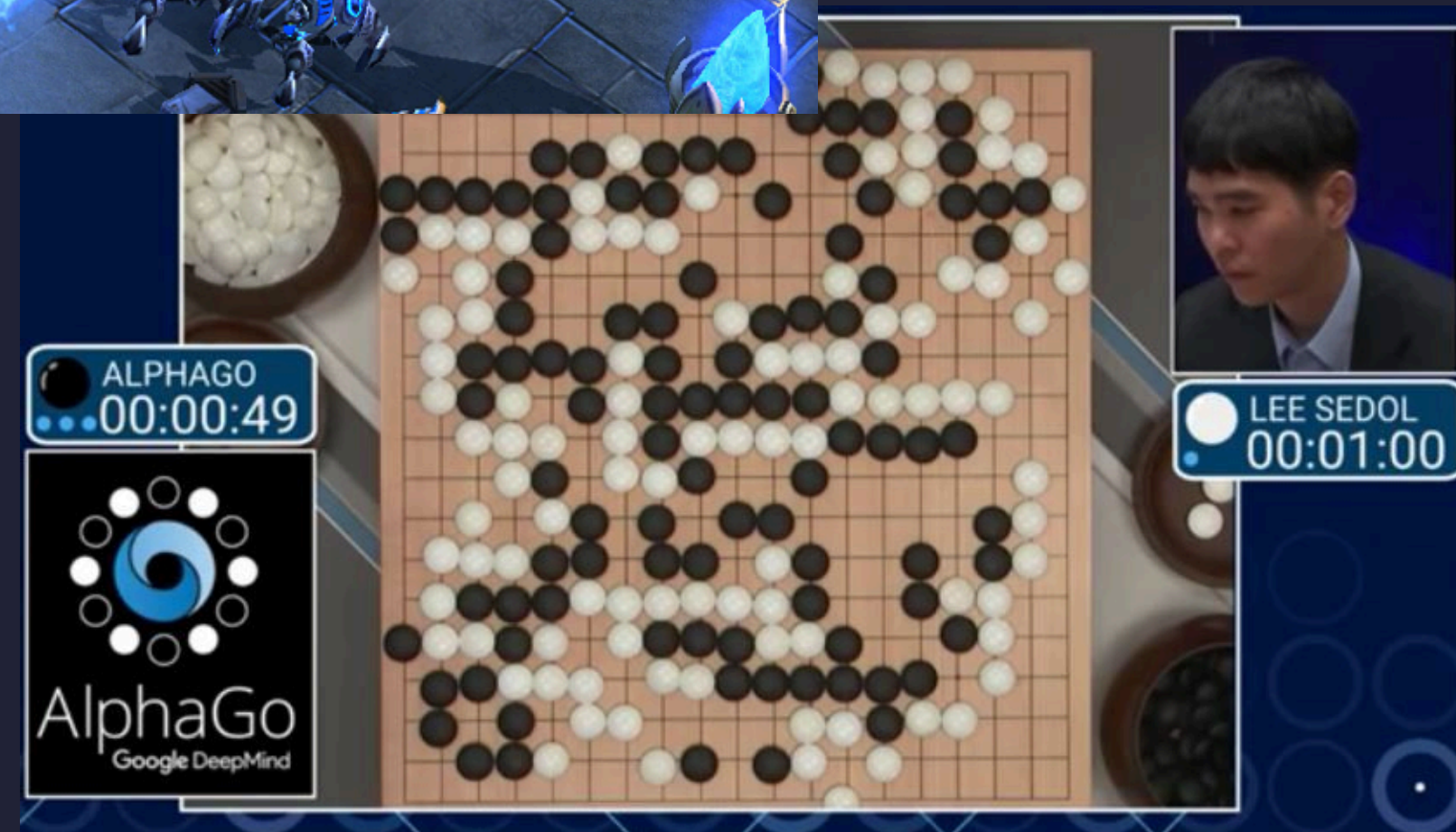
Timo Bertram

PhD student @ Johannes Kepler University Linz

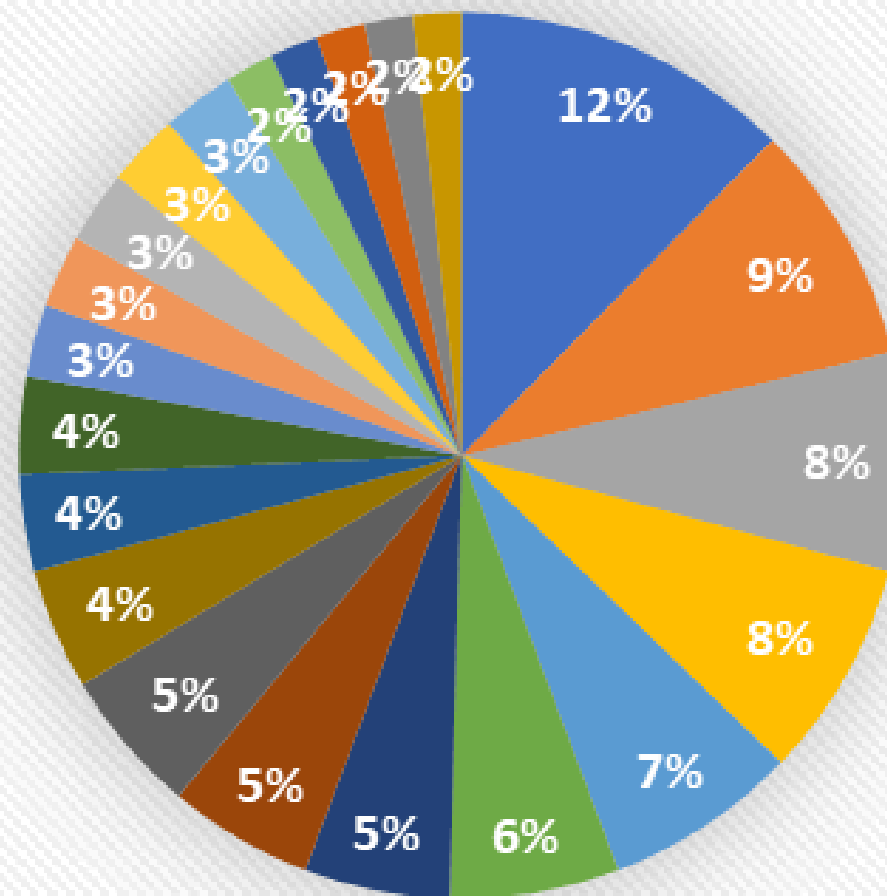




DeepMind

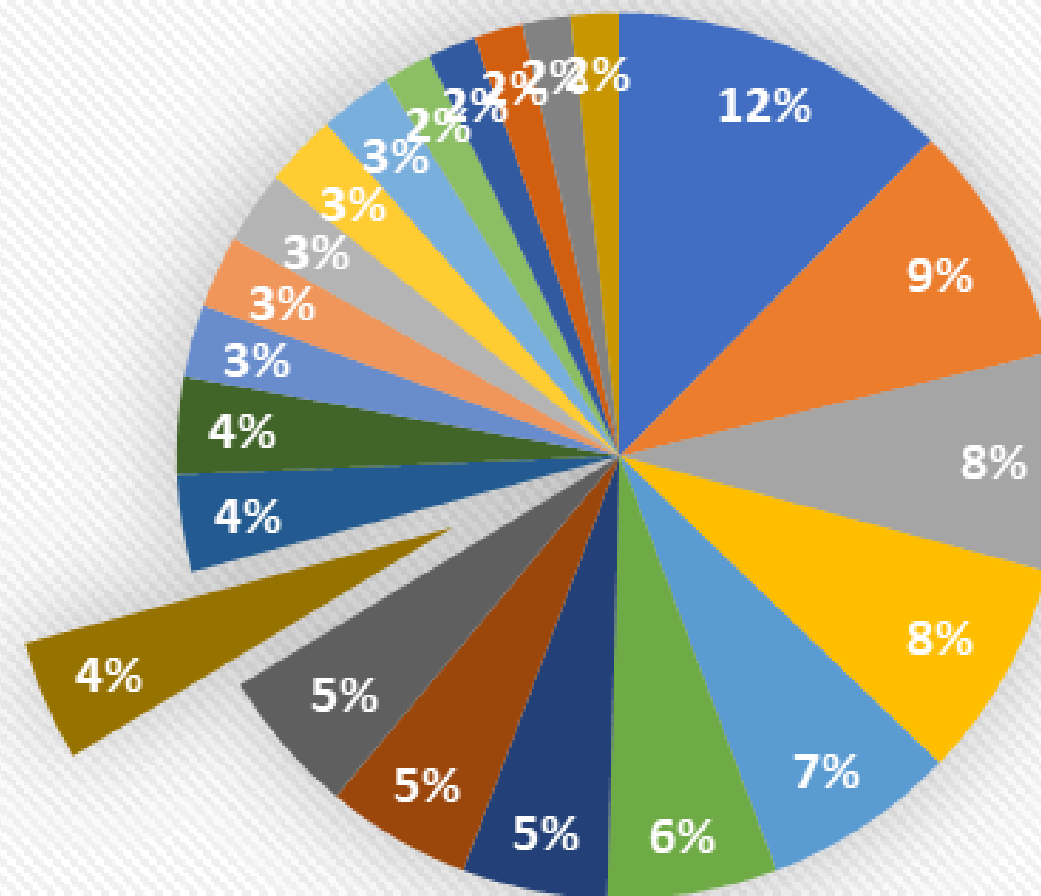


IEEE Conference on Games 2023 submissions



- | | | | | |
|-------------------|---------------|--------------|-----|-----------|
| Education | VR | Custom | 2D | Narrative |
| Atari | Classic Board | Classic Card | FPS | CCG |
| Open World | Fighting | MMO | RTP | Puzzle |
| Language | Other | Quantum | RPG | Racing |
| Modern Board Game | Rhythm | | | |

IEEE Conference on Games 2023 submissions



- | | | | | |
|-------------------|---------------|--------------|-----|-----------|
| Education | VR | Custom | 2D | Narrative |
| Atari | Classic Board | Classic Card | FPS | CCG |
| Open World | Fighting | MMO | RTS | Puzzle |
| Language | Other | Quantum | RPG | Racing |
| Modern Board Game | Rhythm | | | |

Inkmoth Nexus



Land



☞: Add \diamond .

1: Inkmoth Nexus becomes a 1/1 Blinkmoth artifact creature with flying and infect until end of turn. It's still a land.



Who's The Beatdown?

Editor's Note: A long time ago, the first Magic website was The Dojo – a site that is still legendary for publishing some of the most fundamental principles of Magic. Almost all strategical theory can be traced back to the Dojo's loyal writers, and any serious Magic player owes these old vets a debt of...

By [Mike Flores](#) | January 1, 1999

« Prev

1 ... 2405 **2406**

source: <https://articles.starcitygames.com/>

	vs Bant Nadu	vs Ruby Storm	vs Jeskai Control	vs Mono-Black Necro	vs Eldrazi Tron	vs Four-Color Nadu	vs Boros Energy	vs Jeskai Wizards
Dimir Murktide	1-0 (100%)	1-0 (100%)	1-1 (50%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	1-0 (100%)
Living End	4-2 (67%)	0-0 (0%)	3-2 (60%)	2-0 (100%)	0-1 (0%)	1-2 (33%)	0-0 (0%)	0-0 (0%)
Domain Zoo	1-2 (33%)	0-0 (0%)	0-0 (0%)	1-1 (50%)	0-0 (0%)	1-0 (100%)	0-1 (0%)	1-0 (100%)
Bant Control	2-3 (40%)	1-0 (100%)	0-0 (0%)	0-0 (0%)	1-0 (100%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Nardu Midrange	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-1 (0%)	1-0 (100%)
Bant Nadu	X	17-10 (63%)	19-19 (50%)	23-14 (62%)	15-11 (58%)	11-15 (42%)	12-6 (67%)	6-8 (43%)
Gruul Prowess	3-4 (43%)	0-1 (0%)	1-2 (33%)	1-1 (50%)	0-0 (0%)	3-0 (100%)	0-0 (0%)	2-0 (100%)
Boros Burn	1-3 (25%)	3-0 (100%)	1-1 (50%)	0-0 (0%)	2-0 (100%)	1-2 (33%)	1-1 (50%)	1-0 (100%)
Four-Color Nadu	15-11 (58%)	2-0 (100%)	9-2 (82%)	2-2 (50%)	4-5 (44%)	X	4-5 (44%)	2-1 (67%)
Esper Gorye's	5-5 (50%)	1-0 (100%)	3-1 (75%)	0-3 (0%)	1-1 (50%)	1-2 (33%)	3-0 (100%)	3-0 (100%)
Eldrazi Tron	11-15 (42%)	6-3 (67%)	10-7 (59%)	2-5 (29%)	X	5-4 (56%)	3-3 (50%)	2-0 (100%)
Mono-Black Necro	14-23 (38%)	5-2 (71%)	6-2 (75%)	X	5-2 (71%)	2-2 (50%)	2-1 (67%)	1-3 (25%)
Izzet Murktide	2-4 (33%)	0-1 (0%)	4-3 (57%)	4-2 (67%)	0-0 (0%)	2-2 (50%)	1-2 (33%)	2-0 (100%)
Gruul Eldrazi	1-5 (17%)	4-0 (100%)	1-0 (100%)	1-7 (12%)	1-1 (50%)	2-2 (50%)	2-1 (67%)	0-0 (0%)
Boros Energy	6-12 (33%)	6-4 (60%)	4-9 (31%)	1-2 (33%)	3-3 (50%)	5-4 (56%)	X	2-2 (50%)
Sultai Vengevine	0-1 (0%)	0-1 (0%)	1-0 (100%)	0-0 (0%)	1-0 (100%)	0-1 (0%)	0-0 (0%)	0-0 (0%)
Jeskai Control	19-19 (50%)	7-1 (88%)	X	2-6 (25%)	7-10 (41%)	2-9 (18%)	9-4 (69%)	6-1 (86%)
Mono-Black Grief	6-9 (40%)	1-0 (100%)	1-2 (33%)	4-2 (67%)	0-1 (0%)	3-1 (75%)	0-5 (0%)	1-0 (100%)
Jeskai Dress Down	4-5 (44%)	1-0 (100%)	3-3 (50%)	1-2 (33%)	1-5 (17%)	3-2 (60%)	2-0 (100%)	1-0 (100%)
Merfolk	0-1 (0%)	2-0 (100%)	1-0 (100%)	1-1 (50%)	0-0 (0%)	0-2 (0%)	0-0 (0%)	1-0 (100%)
Jeskai Chant	1-2 (33%)	0-0 (0%)	0-0 (0%)	1-2 (33%)	1-0 (100%)	0-0 (0%)	1-1 (50%)	1-0 (100%)
Golgari Yawgmoth	3-5 (38%)	1-2 (33%)	3-1 (75%)	3-1 (75%)	0-1 (0%)	1-1 (50%)	1-0 (100%)	1-1 (50%)
Mardu Energy	1-8 (11%)	1-3 (25%)	2-1 (67%)	1-1 (50%)	2-0 (100%)	3-3 (50%)	0-0 (0%)	1-0 (100%)
Tarmur Eldrazi	0-2 (0%)	1-0 (100%)	2-1 (67%)	1-0 (100%)	0-0 (0%)	1-1 (50%)	1-2 (33%)	1-1 (50%)
Color Reclamation	1-2 (33%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-2 (0%)	0-0 (0%)
Abzan Soultrader	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	1-1 (50%)	0-0 (0%)	0-1 (0%)
Boros Prowess	0-0 (0%)	1-0 (100%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	1-0 (100%)	0-0 (0%)	0-0 (0%)
Grixis Shadow	0-0 (0%)	1-1 (50%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	1-0 (100%)
Jeskai Prowess	0-0 (0%)	0-0 (0%)	1-0 (100%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Dimir Mill	0-2 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)
Dimir Grief	1-0 (100%)	0-1 (0%)	0-0 (0%)	1-1 (50%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Azorius Hammer	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-2 (0%)	0-0 (0%)	1-0 (100%)	0-0 (0%)
Rakdos Grief	1-1 (50%)	2-1 (67%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)
Ruby Storm	10-17 (37%)	X	1-7 (12%)	2-5 (29%)	3-6 (33%)	0-2 (0%)	4-6 (40%)	2-3 (40%)
Jeskai Wizards	8-6 (57%)	3-2 (60%)	1-6 (14%)	3-1 (75%)	0-2 (0%)	1-2 (33%)	2-2 (50%)	X
Amulet Titan	0-1 (0%)	1-2 (33%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Four-color Control	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-1 (0%)	0-0 (0%)
Izzet Wizards	1-3 (25%)	1-0 (100%)	1-0 (100%)	1-1 (50%)	0-2 (0%)	0-1 (0%)	0-3 (0%)	1-1 (50%)
Dimir Nethergoyle	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)
Gruul Scapeshift	0-1 (0%)	0-0 (0%)	0-2 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Devoted Nadu	0-2 (0%)	0-0 (0%)	0-1 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Jund Creativity	0-0 (0%)	0-1 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	1-1 (50%)	0-0 (0%)
Hardened Scales	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Mono-Red Prowess	0-1 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)

Results are based on non-mirror/non-byenon-draw matches from Swiss rounds. Note that sample sizes are small.

	vs Bant Nadu	vs Ruby Storm	vs Jeskai Control	vs Mono-Black Necro	vs Eldrazi Tron	vs Four-Color Nadu	vs Boros Energy	vs Jeskai Wizards
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Nardu Midrange	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-1 (0%)	1-0 (100%)
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Mertok	0-1 (0%)	2-0 (100%)	1-0 (100%)	1-1 (50%)	0-0 (0%)	0-2 (0%)	0-0 (0%)	1-0 (100%)
Jeskai Chant	1-2 (33%)	0-0 (0%)	0-0 (0%)	1-2 (33%)	1-0 (100%)	0-0 (0%)	1-1 (50%)	1-0 (100%)
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Boros Prowess	0-0 (0%)	1-0 (100%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	1-0 (100%)	0-0 (0%)	0-0 (0%)
Grixis Shadow	0-0 (0%)	1-1 (50%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	1-0 (100%)
Jeskai Prowess	0-0 (0%)	0-0 (0%)	1-0 (100%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Dimir Mill	0-2 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)
Dimir Grief	1-0 (100%)	0-1 (0%)	0-0 (0%)	1-1 (50%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Azorius Hammer	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-2 (0%)	0-0 (0%)	1-0 (100%)	0-0 (0%)
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Amulet Titan	0-1 (0%)	1-2 (33%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Four-color Control	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-1 (0%)	0-0 (0%)
Izzet Wizards	1-3 (25%)	1-0 (100%)	1-0 (100%)	1-1 (50%)	0-2 (0%)	0-1 (0%)	0-3 (0%)	1-1 (50%)
Dimir Nethergoyle	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)
Gruul Scapeshift	0-1 (0%)	0-0 (0%)	0-2 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Devoted Nadu	0-2 (0%)	0-0 (0%)	0-1 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Jund Creativity	0-0 (0%)	0-1 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	1-1 (50%)	0-0 (0%)
Hardened Scales	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)
Mono-Red Prowess	0-1 (0%)	0-0 (0%)	0-1 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)	0-0 (0%)

Results are based on non-mirror/non-byematch draws from Swiss rounds. Note that sample sizes are small.

ALL CARD SETS USED WITH THEIR RESPECTIVE RELEASE DATA AND TRAINING SET SIZE.

Set	Release date	Training size
LTR	23-06-2023	684,724
MOM	21-04-2023	5,085,312
SIR	21-03-2023	2,422,668
ONE	10-02-2023	5,260,169
BRO	18-11-2022	4,153,162
DMU	09-09-2022	7,887,976
HBG	07-07-2022	1,680,866
SNC	29-04-2022	5,753,840
NEO	18-02-2022	5,122,921
VOW	19-21-2021	4,012,657
MID	24-09-2021	3,363,477
AFR	23-07-2021	959,794
STX	23-04-2021	3,809,102
M19	07-07-2018	29,094,192

Constructed

Draft



Constructed



Pro Tour Modern Horizons 3

[View as Slideshow](#) | [Expand Decks](#)

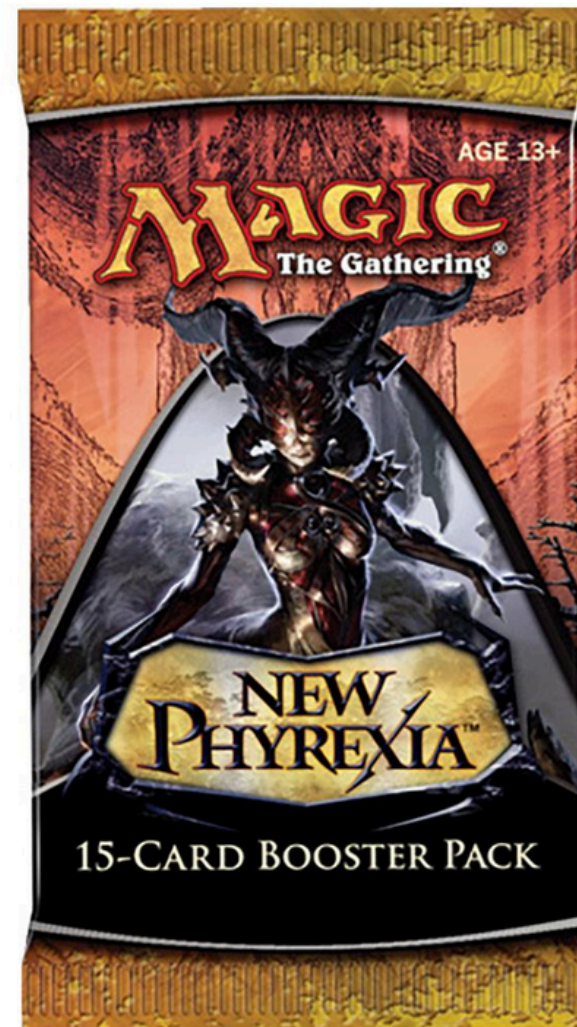
Format: Modern

Date: 2024-06-28

Source: magic.gg

Place	Deck	Pilot
1st	Bant Nadu 	Simon Nielsen
2nd	Bant Nadu 	Sam Pardee
4th	Bant Nadu 	Eli Kassis
4th	Four-Color Nadu 	Daniel Goetschel
8th	Mono-Black Necro 	Noah Ma
8th	Bant Nadu 	Jason Ye
8th	Jeskai Control 	Javier Dominguez
8th	Mono-Black Necro 	Seth Manfield

Draft






0 Total 0 Creatures 0 Land 0 Other

 <p>Barrowgoyf Creature — Lhurgoyf Deathtouch, lifelink Barrowgoyf's power is equal to the number of card types among cards in all graveyards and its...</p>	 <p>Celestial Colonnade Land Celestial Colonnade enters tapped. Add or . Until end of turn, Celestial Colonnade...</p>	 <p>Fabled Passage Land Sacrifice Fabled Passage: Search your library for a basic land card, put it onto the battlefield tapped, then shuffle. Then...</p>	 <p>Imperial Seal Sorcery Search your library for a card, then shuffle and put that card on top. You lose 2 life.</p>	 <p>Lion Sash Artifact Creature — Equi... Exile target card from a graveyard. If it was a permanent card, put a +1/+1 counter on Lion Sash....</p>	 <p>Malcolm, Alluring Scoundrel Legendary Creature — Sir... Flash Flying Whenever Malcolm, Alluring Scoundrel deals combat damage to a player, put a...</p>	 <p>Souls of the Lost Creature — Spirit As an additional cost to cast this spell, discard a card or sacrifice a permanent. Fathomless descent —...</p>	 <p>Sylvan Safekeeper Creature — Human Wizard Sacrifice a land: Target creature you control gains shroud until end of turn.</p>	 <p>Vendilion Clique Legendary Creature — F... Flash Flying When Vendilion Clique enters, look at target player's hand. You may...</p>	 <p>Lightning Greaves Artifact — Equipment Equipped creature has haste and shroud. Equip</p>
 <p>Soul-Guide Lantern Artifact When Soul-Guide Lantern enters, exile target card from a graveyard. Sacrifice Soul-Guide Lantern: Exile each opponent's graveyard.</p>	 <p>Tough Cookie Artifact Creature — Food... When Tough Cookie enters, create a Food token. Target noncreature artifact you control...</p>	 <p>Burst Lightning Instant Kicker Burst Lightning deals 2 damage to any target. If this spell was kicked, it deals 4 damage instead.</p>	 <p>Orcish Lumberjack Creature — Orc Sacrifice a Forest: Add three mana in any combination of and/or.</p>						

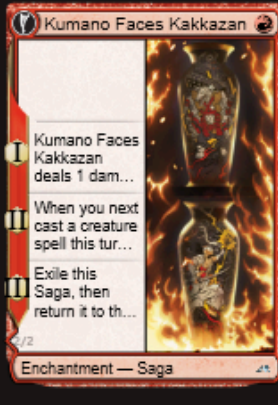
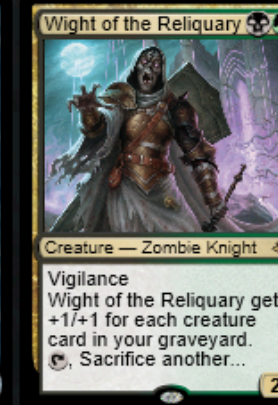
1 Total 0 Creatures 0 Land 1 Other

Last Selected: Mox Jet

1



Mox Jet
Artifact
Add



2 Total 1 Creatures 0 Land 1 Other

1



Last Selected: Barrowgoyf

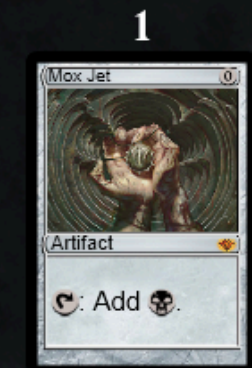
1





3 Total 2 Creatures 0 Land 1 Other

Last Selected: Ignoble Hierarchy





15 Total 7 Creatures 1 Land 7 Other

Last Selected: Zuran Orb



14	2	6	7	6	2	1	1	1
<p>Badlands</p> <p>Forest</p> <p>Forest</p> <p>Forest</p> <p>Forest</p> <p>Forest</p> <p>Forest</p> <p>Forest</p> <p>March Flats</p> <p>Dollared Delta</p> <p>Swamp</p> <p>Swamp</p> <p>Swamp</p> <p>Yavimaya, Cradle of Growth</p> <p>Legendary Land</p> <p>Each land is a Forest in addition to its other land...</p>	<p>Mox Diamond 0</p> <p>Mox Jet 0</p> <p>Artifact</p> <p>☉: Add ☠.</p>	<p>Dark Ritual</p> <p>Dürees</p> <p>Elvish Mystic</p> <p>Ignoble Hierarch</p> <p>Llanowar Elves</p> <p>Sol Ring 1</p> <p>Artifact</p> <p>☉: Add ☉☉.</p>	<p>Animate Dead 1 ☠</p> <p>Deep-Cavern Bat 1 ☠</p> <p>Lotus Cobra 1</p> <p>Malevolent Rumble 1</p> <p>Once Upon a Time 1</p> <p>Springheart Nantuko 1</p> <p>Sylvan Caryatid 1</p> <p>Creature — Plant</p> <p>Defender, hexproof</p> <p>☉: Add one mana of any color.</p> <p>0/3</p>	<p>Barrowgoyf 2 ☠</p> <p>Necromancy</p> <p>Disember 1 ☠☠</p> <p>Tireless Tracker 2</p> <p>Grist, the Hunger... 1 ☠</p> <p>Palantir of Orthanc 3</p> <p>Legendary Artifact</p> <p>At the beginning of your end step, put an influence counter on Palantir of Orthanc and scry 2. Then target opponent may have you draw a card. If that...</p>	<p>Ulvenwald Oddity 2</p> <p>Minsc & Boo, Tim... 2</p> <p>Legendary Planeswalker</p> <p>When Minsc & Boo,...</p> <p>Put three +1/+1</p> <p>Sacrifice a creature...</p> <p>Minsc & Boo,...</p> <p>3</p>	<p>Generous Ent 5</p> <p>Creature — Treefolk</p> <p>Reach</p> <p>When Generous Ent enters, create a Food token.</p> <p>5/7</p>	<p>Vaultborn Tyrant 5</p> <p>Creature — Dinosaur</p> <p>Trample</p> <p>Whenever Vaultborn Tyrant or another creature you control wi...</p> <p>6/6</p>	<p>Mind Twist X ☠</p> <p>Sorcery</p> <p>Target player discards X cards at random.</p>

Booster 2/3 13 Cards Available
Select 1 (0 remaining)

0:40

SUBMIT

[o] [people] [funnel] [trash]

<p>Thraben Inspector Creature — Human Soldier When Thraben Inspector enters, investigate. 1/2</p>	<p>Psychic Frog Creature — Frog Whenever Psychic Frog deals combat damage to a player or planeswalker, draw a card. Discard a card. Put a +1/+1 counter on Psychic Frog. Exile three cards from your gr... 1/2</p>	<p>Blightsteel Colossus Artifact Creature — Phyre... Trample, infect, indestructible If Blightsteel Colossus would be put into a graveyard from anywhere... 11/11</p>	<p>Dark Confidant Creature — Human Wizard At the beginning of your upkeep, reveal the top card of your library and put that card into your hand. You lose life equal to its mana... Reserved 2/1</p>	<p>Botanical Sanctum Land Botanical Sanctum enters tapped unless you control two or fewer other lands. Add ♣ or ♠.</p>	<p>Ignoble Hierarch Creature — Goblin Shaman Exalted Add ♣, ♠, or ♣.</p>	<p>Preacher of the Schism Creature — Vampire Cleric Deathtouch Whenever Preacher of the Schism attacks the player with the most life or tied for most life, create a 1/1 whi... 2/4</p>	<p>Chart a Course Sorcery Draw two cards. Then discard a card unless you attacked this turn.</p>	<p>Kumano Faces Kakkazan Enchantment — Saga Kumano Faces Kakkazan deals 1 dam... When you next cast a creature spell this tur... Exile this Saga, then return it to th... 1/2</p>
<p>Rain of Filth Instant Until end of turn, lands you control gain "Sacrifice this land: Add ♣." 1/1</p>	<p>Benevolent Bodyguard Creature — Human Cleric Sacrifice Benevolent Bodyguard: Target creature you control gains protection from the color of your choice until end of turn. 1/1</p>	<p>Expedition Map Artifact 2, ♣ Sacrifice Expedition Map: Search your library for a land card, reveal it, put it into your hand, then shuffle.</p>	<p>Gush Instant You may return two Islands you control to their owner's hand rather than pay this spell's mana cost. Draw two cards.</p>					

17 Total 5 Creatures 4 Land 8 Other

Last Selected: Mox Diamond

2	1	1	1	2	3	4	1	2
<p>Oroish Lumberjack Deathrite Shaman Creature — Elf Shaman Exile target land card from a graveyard. Add one mana of any color. Exile target instant or sorcery card from a gravey... 1/2</p>	<p>Dauthi Voidwalker Creature — Dauthi Rogue Shadow If a card would be put into an opponent's graveyard from anywhere, instead exile it with a void counter on it. Sacrifice Dauthi Voidwal... 3/2</p>	<p>Blood Crypt Land — Swamp Mountain As Blood Crypt enters, you may pay 2 life. If you don't, it enters tapped.</p>	<p>Arid Mesa Land Pay 1 life. Sacrifice Arid Mesa: Search your library for a Mountain or Plains card, put it onto the battlefield, then shuffle.</p>	<p>Restless Vents Raging Ravine Land Raging Ravine enters tapped. Add ♣ or ♠. Until end of turn, Raging Ravine beco...</p>	<p>Miehra's Bauble Mox Diamond Bone Shards Sorcery As an additional cost to cast this spell, sacrifice a creature or discard a card. Destroy target creature or planeswalker.</p>	<p>Virtue of Persistence Animate Dead Abrade Instant Choose one — • Abrade deals 3 damage to target creature. • Destroy target artifact.</p>	<p>Ghostfire Slice Instant Devoid This spell costs 2 less to cast if an opponent controls a multicolored permanent...</p>	<p>Pyrogoyf Lurrus of the Dream Legendary Creature — ... Companion — Each permanent card in your starting deck has mana value 2 or less... 3/2</p>

Booster 2/3 13 Cards Available Select 1 (0 remaining)

0:40

SUBMIT



 Creature — Human Soldier When Thraben Inspector enters, investigate. 1/2	 Creature — Frog Whenever Psychic Frog deals combat damage to a player or planeswalker, draw a card. Discard a card. Put a +1/+1 counter on Psychic Frog. Exile three cards from your gr... 1/2	 Artifact Creature — Phyre... Trample, infect, indestructible If Blightsteel Colossus would be put into a graveyard from anywhere... 11/11	 Creature — Human Wizard At the beginning of your upkeep, reveal the top card of your library and put that card into your hand. You lose life equal to its mana... Reserved 2/1	 Land Botanical Sanctum enters tapped unless you control two or fewer other lands. Add ♣ or ♠.	 Creature — Goblin Shaman Exalted Add ♣, ♠, or ♡.	 Creature — Vampire Cleric Deathfouch Whenever Preacher of the Schism attacks the player with the most life or tied for most life, create a 1/1 whi... 2/4	 Sorcery Draw two cards. Then discard a card unless you attacked this turn.	 Enchantment — Saga Kumano Faces Kakkazan deals 1 dam... When you next cast a creature spell this tur... Exile this Saga, then return it to th... 1/2
 Instant Until end of turn, lands you control gain "Sacrifice this land: Add ♠." 1/1	 Creature — Human Cleric Sacrifice Benevolent Bodyguard: Target creature you control gains protection from the color of your choice until end of turn. 1/1	 Artifact 2, ♣, Sacrifice Expedition Map: Search your library for a land card, reveal it, put it into your hand, then shuffle.	 Instant You may return two Islands you control to their owner's hand rather than pay this spell's mana cost. Draw two cards.					

17 Total 5 Creatures 4 Land 8 Other

Last Selected: Mox Diamond

2	1	1	1	2	3	4	1	2
 Deathrite Shaman Creature — Elf Shaman Exile target land card from a graveyard. Add one mana of any color. Exile target instant or sorcery card from a gravey... 1/2	 Creature — Dauthi Rogue Shadow If a card would be put into an opponent's graveyard from anywhere, instead exile it with a void counter on it. Sacrifice Dauthi Voidwal... 3/2	 Land — Swamp Mountain As Blood Crypt enters, you may pay 2 life. If you don't, it enters tapped.	 Land Pay 1 life. Sacrifice Arid Mesa: Search your library for a Mountain or Plains card, put it onto the battlefield, then shuffle.	 Raging Ravine Land Raging Ravine enters tapped. Add ♣ or ♠. Until end of turn, Raging Ravine beco...	 Mox Diamond Bone Shard Sorcery As an additional cost to cast this spell, sacrifice a creature or discard a card. Destroy target creature or planeswalker.	 Animate Dead Abrade Instant Choose one — • Abrade deals 3 damage to target creature. • Destroy target artifact.	 Instant Devoid This spell costs 2 less to cast if an opponent controls a multicolored permanent...	 Lurrus of the Dream Legendary Creature — ... Companion — Each permanent card in your starting deck has mana value 2 or less... 3/2

Input



Target



Input



But what was in the pack?

Target



Context



Positive

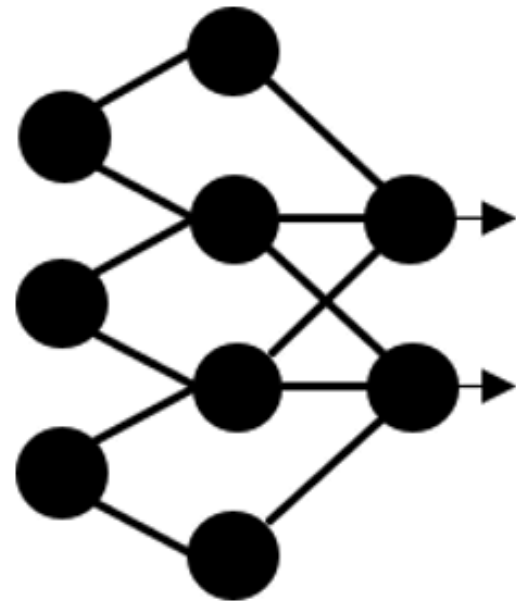


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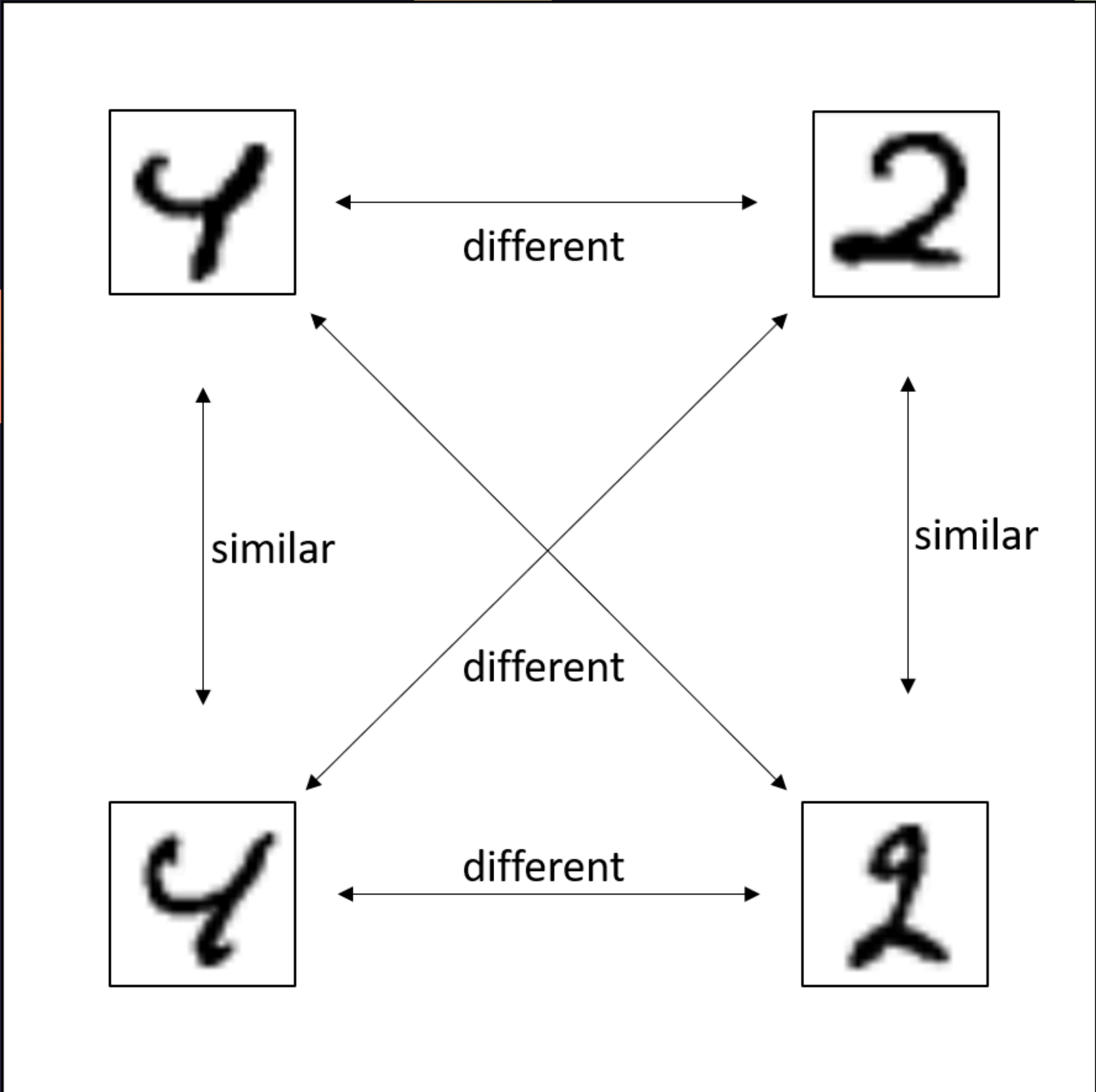


CONTRASTIVE LEARNING

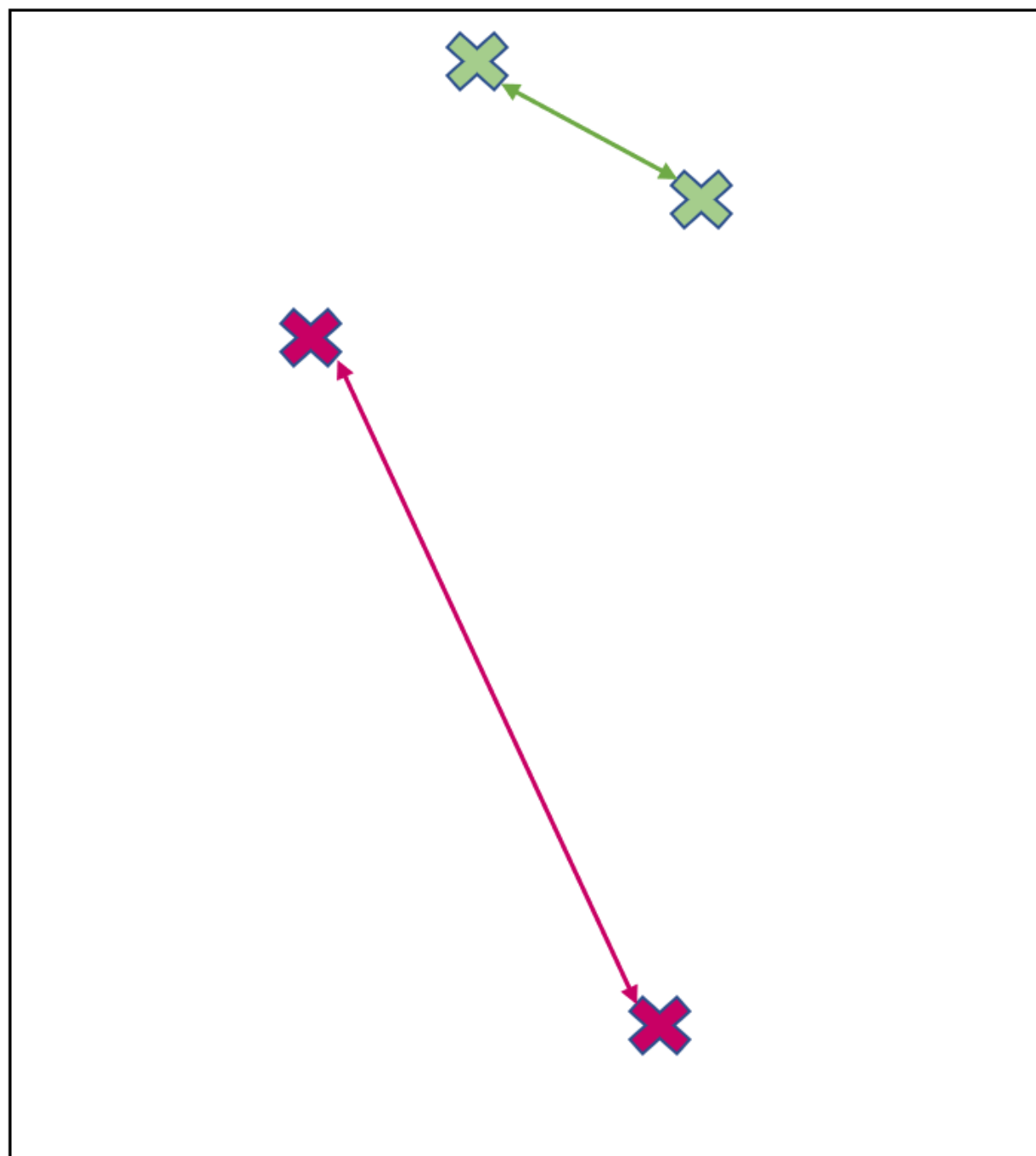
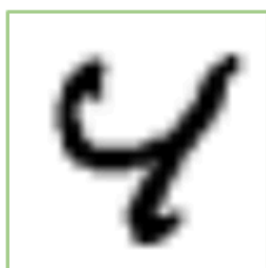


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- 0.03
- 0.00
- 0.74
- 0.02
- 0.00
- 0.08
- 0.01
- 0.02

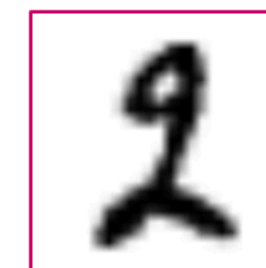
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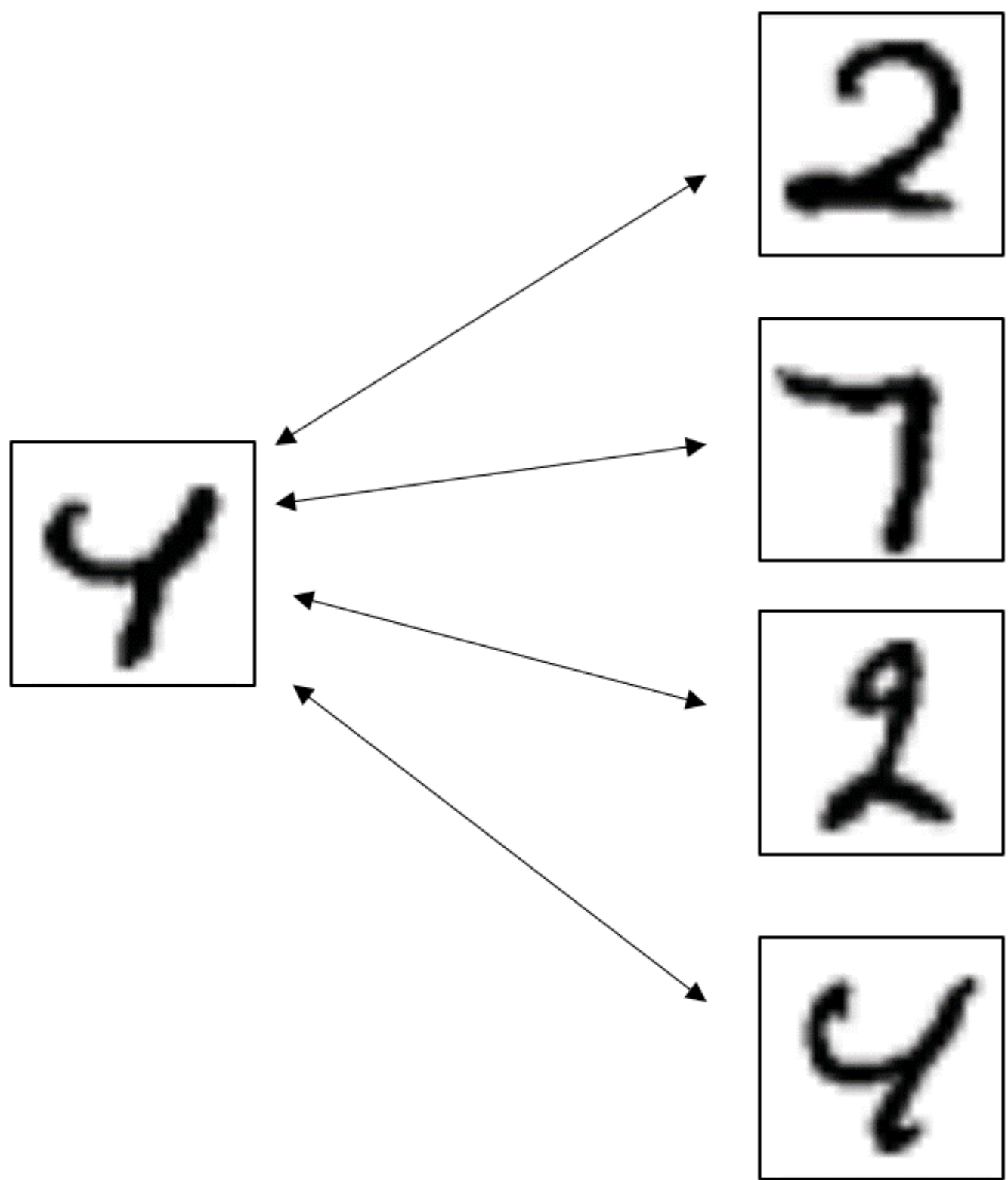


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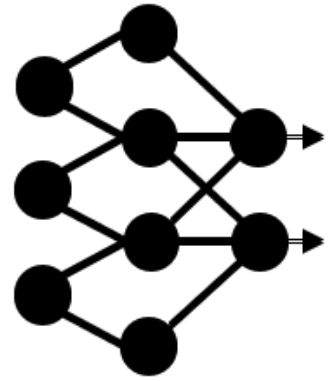
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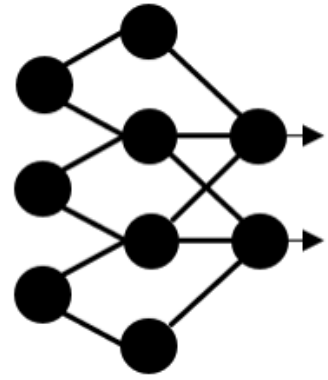


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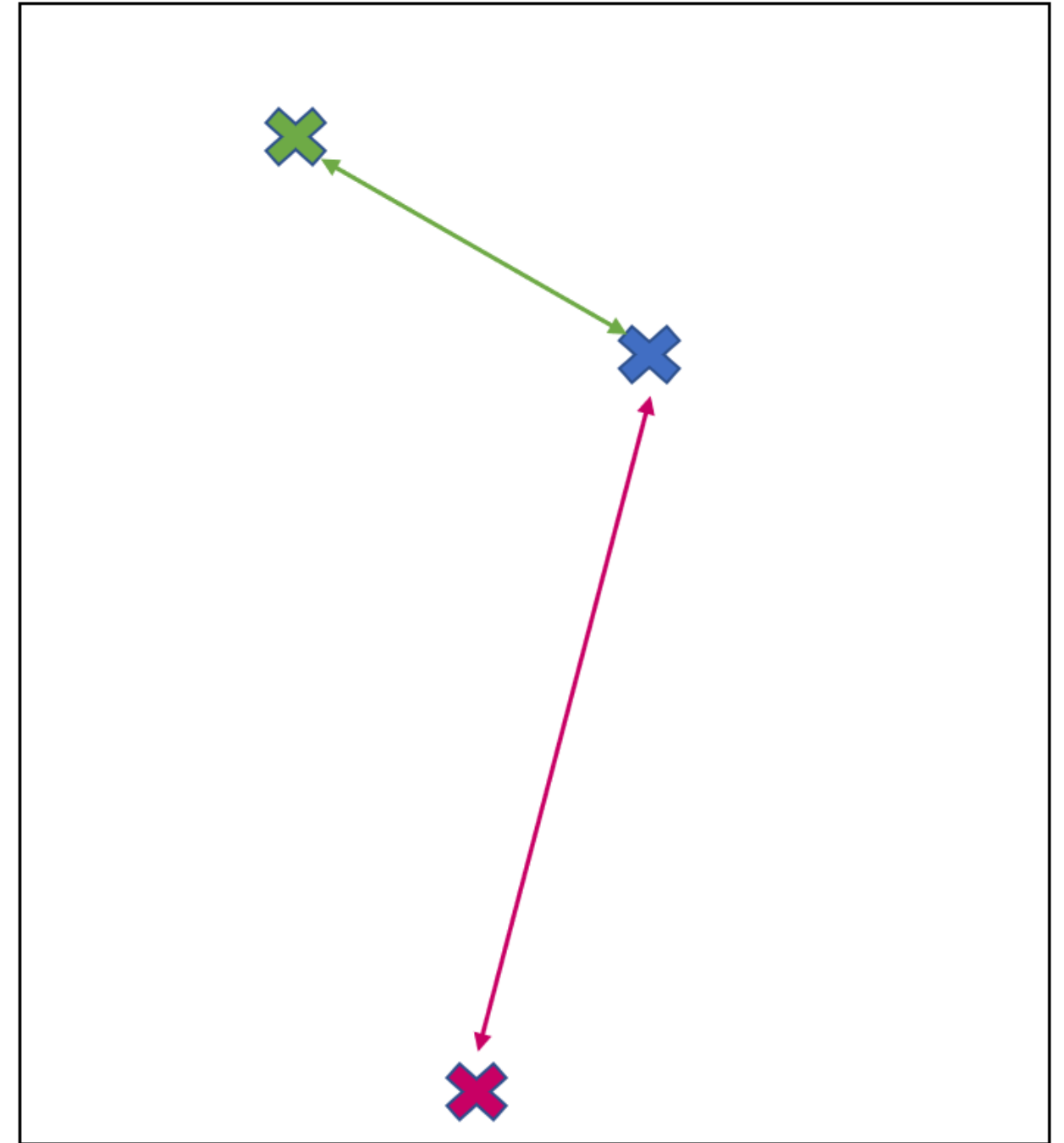
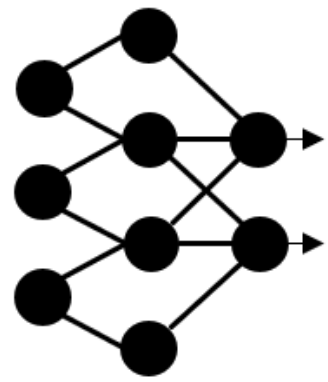
Context



Positive



Negative



Context



Positive



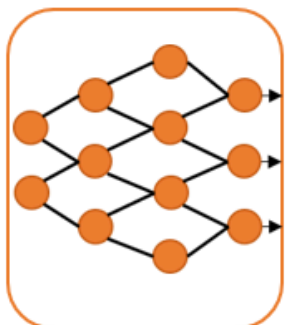
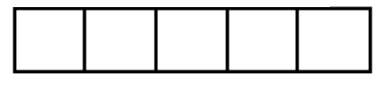
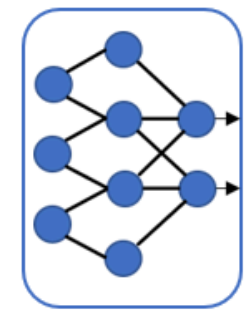
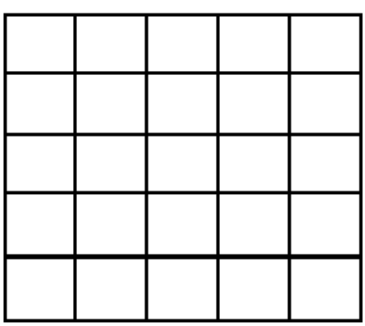
Negative(s)



Deck



Representation pipeline



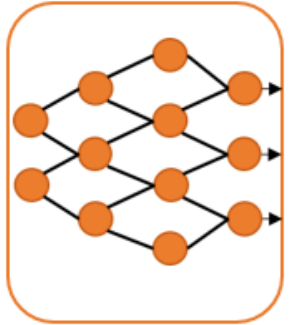
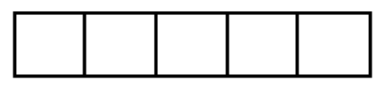
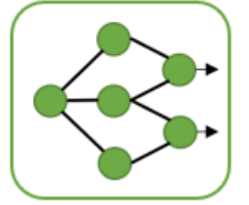
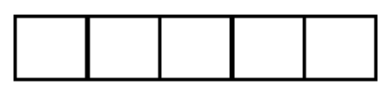
Deck encoding Card encoding Siamese Network

Embedding space

Positive



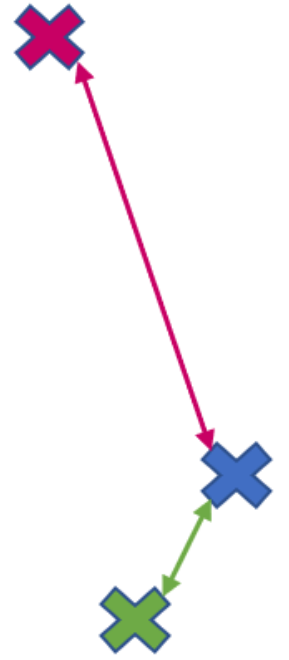
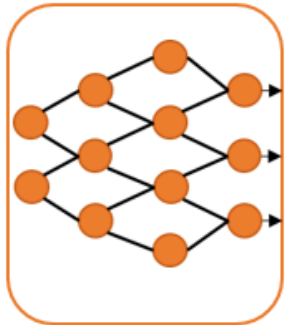
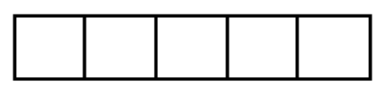
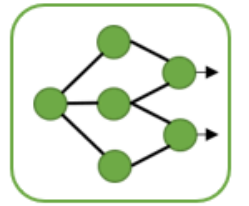
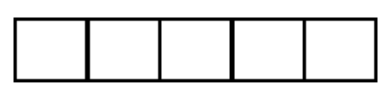
Representation pipeline

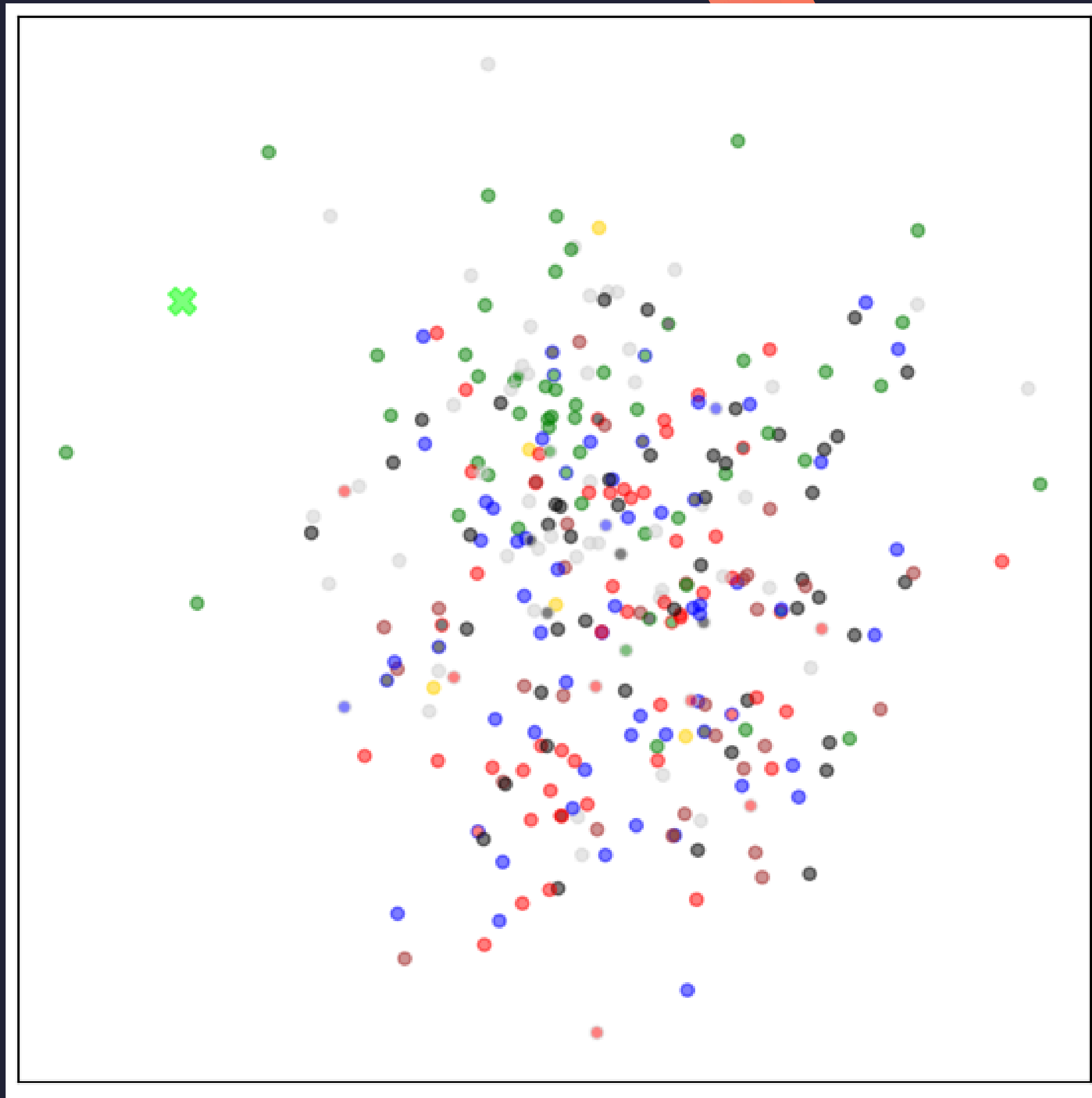


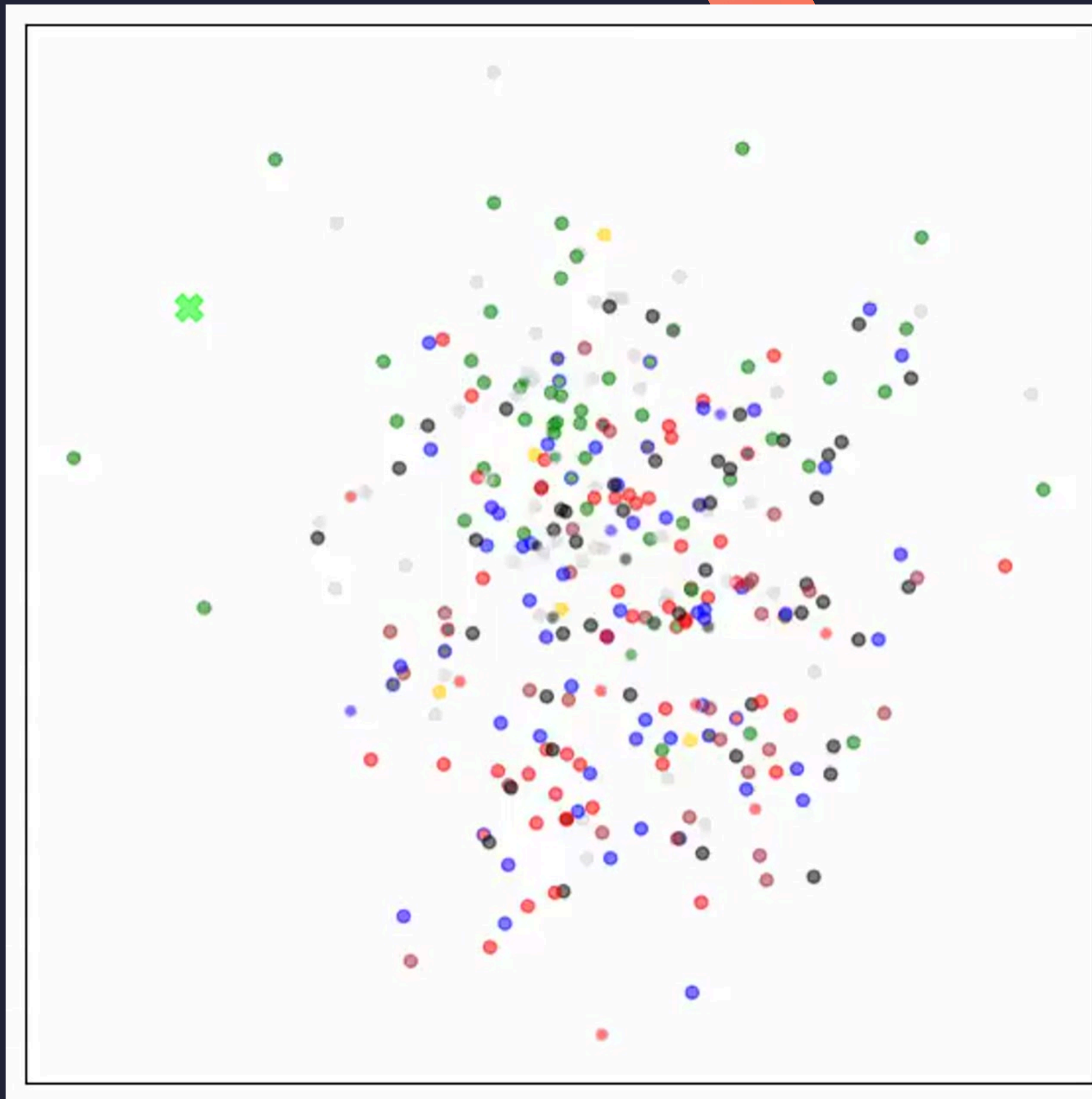
Negative



Representation pipeline









The image features a dark blue background with abstract, flowing shapes. A large, thick ring with a teal-to-orange gradient is positioned in the upper left. Below it, several thick, curved ribbons in the same gradient flow across the bottom of the frame. The word "REPRESENTATION" is centered in a bold, white, sans-serif font.

REPRESENTATION

Underdark Explorer

4 



Creature — Lizard Warrior 

Menace (This creature can't be blocked except by two or more creatures.)

When Underdark Explorer enters the battlefield, you take the initiative.

"Keep your fancy magic. All I need is a hook and a sturdy length of rope."

5/3

Natural language



Underdark Explorer

4



Numerical



Visual



Creature

Lizard Warrior



Categorical



Categorical



Menace (This creature can't be blocked except by two or more creatures.)

When Underdark Explorer enters the battlefield, you take the initiative.

"Keep your fancy magic. All I need is a hook and a sturdy length of rope."

Natural language




5/3


Numerical



Underdark Explorer

4 



Creature — Lizard Warrior 

Menace (This creature can't be blocked except by two or more creatures.)

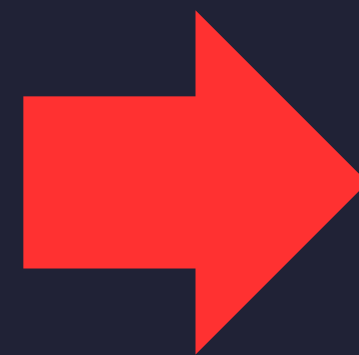
When Underdark Explorer enters the battlefield, you take the initiative.

"Keep your fancy magic. All I need is a hook and a sturdy length of rope."

5/3

154/361 C
CLB • EN  DAVID ASTRUGA

™ & © 2022 Wizards of the Coast




0,0,0,1,0,0,0,0,0,...,0

Underdark Explorer

4 



Creature — Lizard Warrior 

Menace (*This creature can't be blocked except by two or more creatures.*)

When Underdark Explorer enters the battlefield, you take the initiative.

"Keep your fancy magic. All I need is a hook and a sturdy length of rope."

5/3



~~0,0,0,1,0,0,0,0,...,0~~

Underdark Explorer

4 



Creature — Lizard Warrior



Menace (This creature can't be blocked except by two or more creatures.)

When Underdark Explorer enters the battlefield, you take the initiative.

"Keep your fancy magic. All I need is a hook and a sturdy length of rope."

5/3

0.13,0.3

0.2,0.91

0.23,0.1

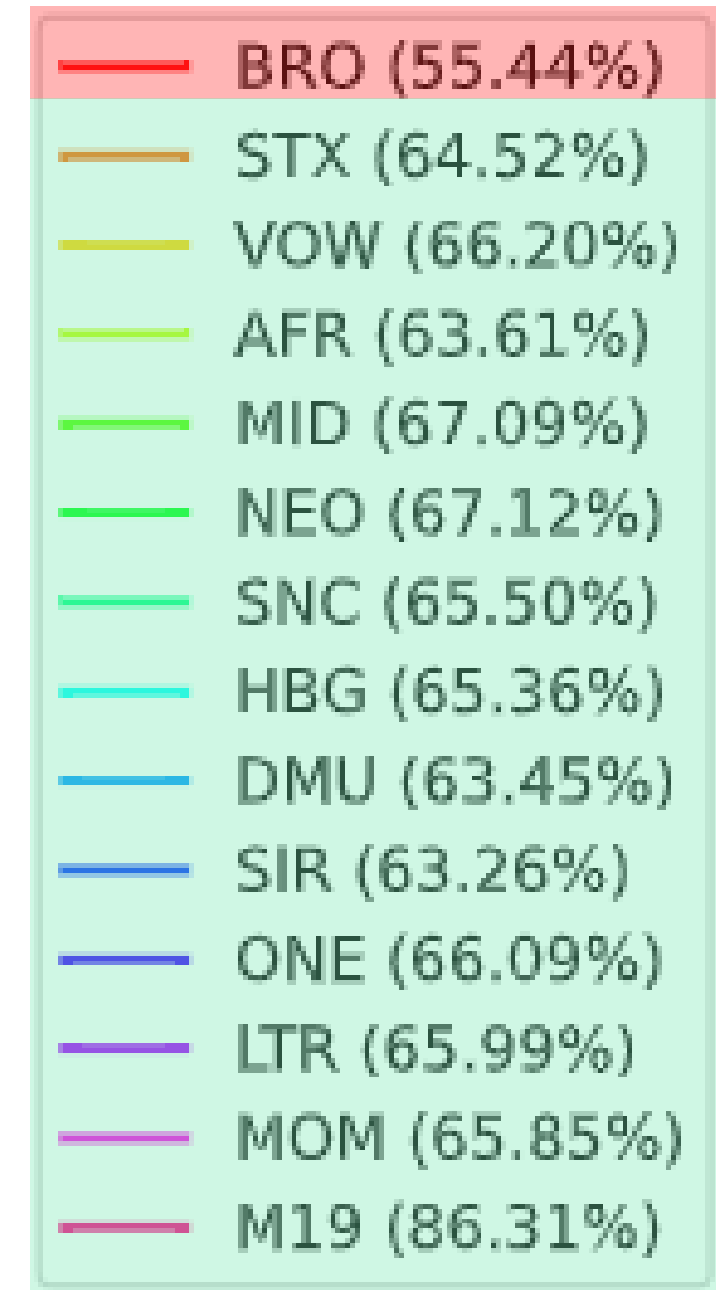
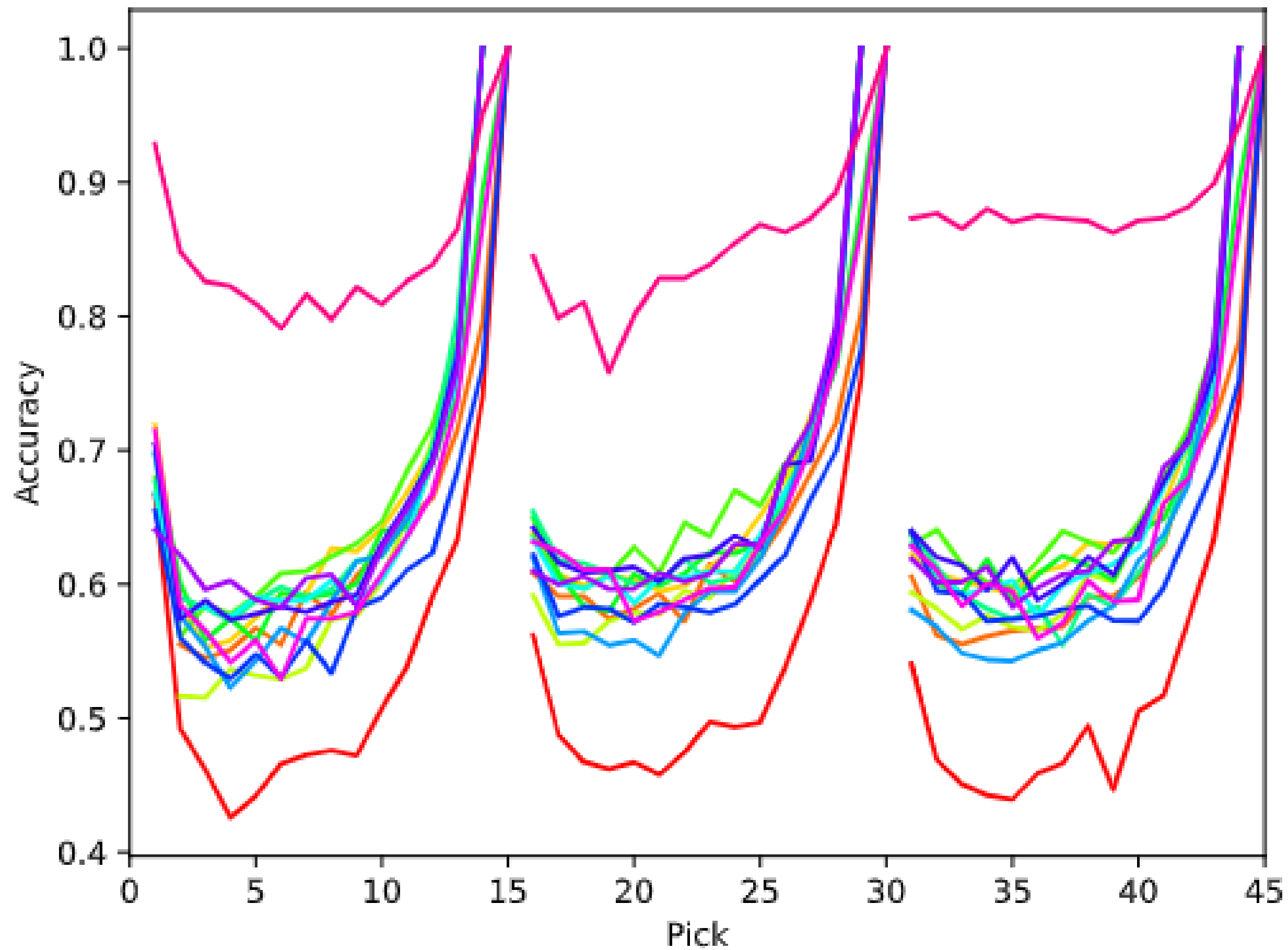
ALL CARD SETS USED WITH THEIR RESPECTIVE RELEASE DATA AND TRAINING SET SIZE.

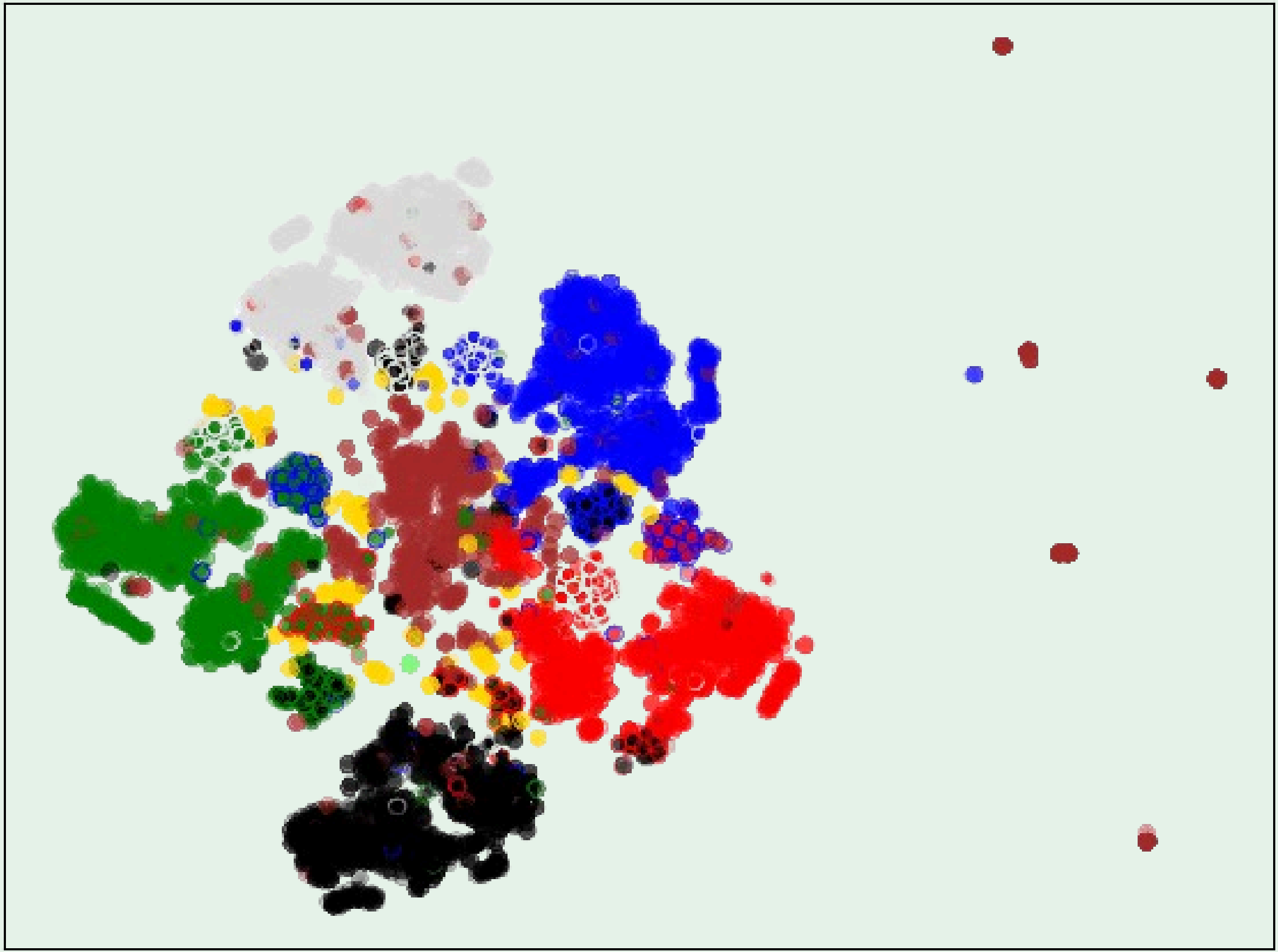
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MOM	21-04-2023	5,085,312
SIR	21-03-2023	2,422,668
ONE	10-02-2023	5,260,169
BRO	18-11-2022	4,153,162
DMU	09-09-2022	7,887,976
HBG	07-07-2022	1,680,866
SNC	29-04-2022	5,753,840
NEO	18-02-2022	5,122,921
VOW	19-21-2021	4,012,657
MID	24-09-2021	3,363,477
AFR	23-07-2021	959,794
STX	23-04-2021	3,809,102
M19	07-07-2018	29,094,192

Representation	Test accuracy on known cards (NEO)	Test accuracy on unknown cards
Random vectors		
Latent image encodings		
Feature encodings		
Features + Image		

Representation	Test accuracy on known cards (NEO)	Test accuracy on unknown cards
Random vectors	67.87%	
Latent image encodings	68.09%	
Feature encodings	67.76%	
Features + Image	68.00%	

Representation	Test accuracy on known cards (NEO)	Test accuracy on unknown cards
Random vectors	67.87%	23.79%
Latent image encodings	68.09%	31.10%
Feature encodings	67.76%	33.57%
Features + Image	68.00%	35.59%





The background is a dark blue gradient. On the left side, there are several abstract, colorful shapes. At the top left, there is a large, thick ring with a gradient from light green to orange. Below it, there are several thick, wavy lines that also follow the green-to-orange gradient, creating a sense of movement and depth. The text is centered in the middle of the image.

RECONNAISSANCE BLIND CHESS



Opponent: Trout

Color: White

Sense ---- :

No capture

Sense c7 :



No capture

Sense f5 :



No capture

Sense d6 :



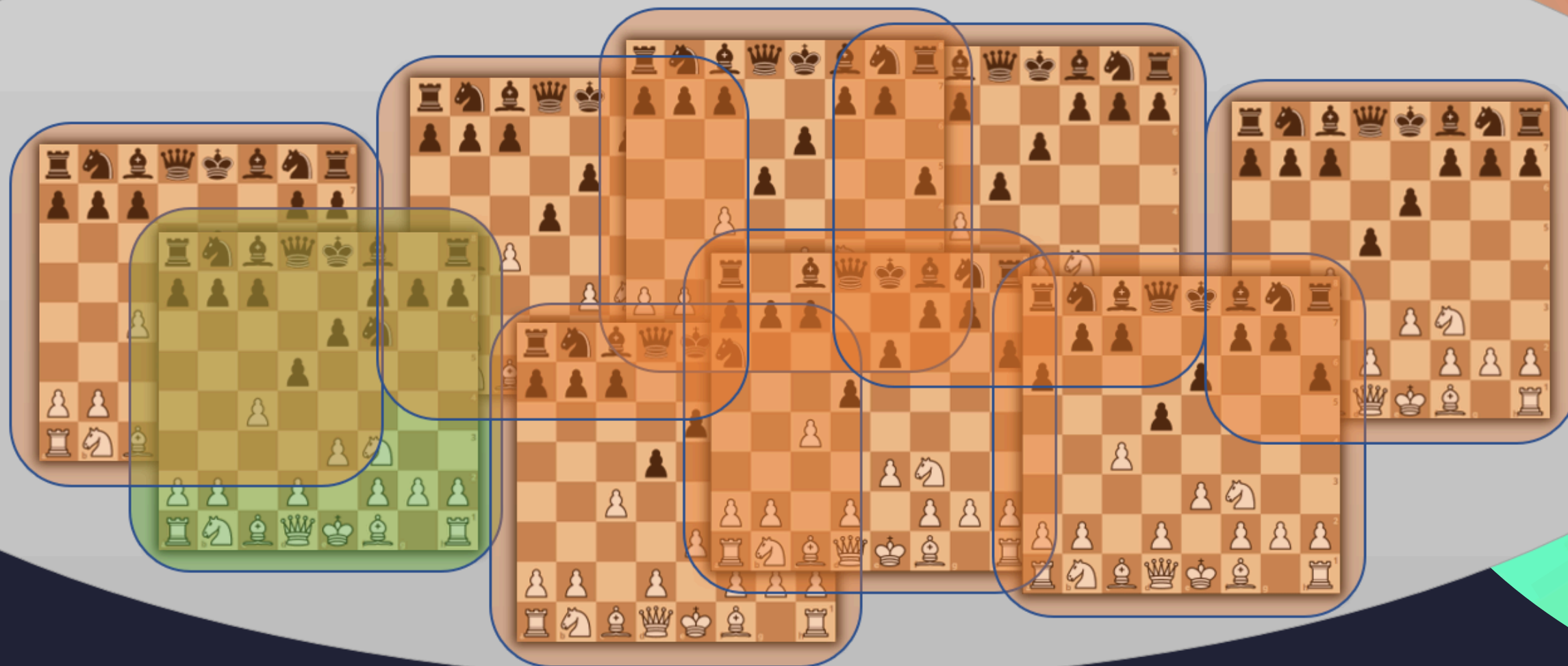
Move e3 : ✓

Move c4 : ✓

Move Nf3: ✓



Information Set





0.31

0.29

0.16

0.19

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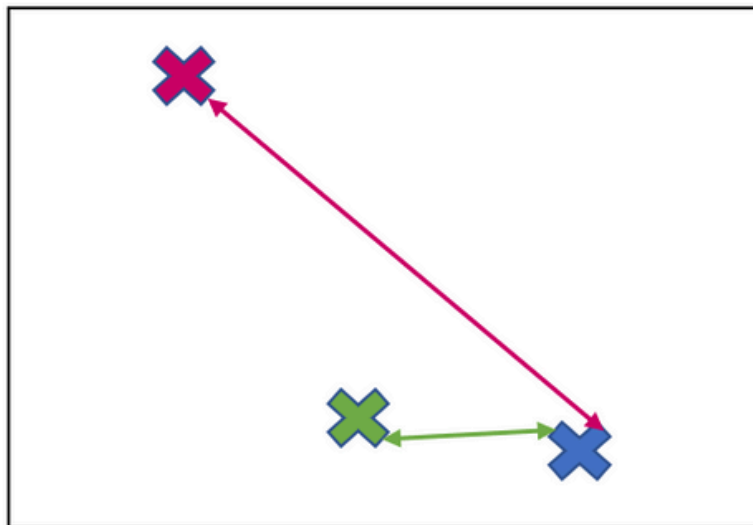
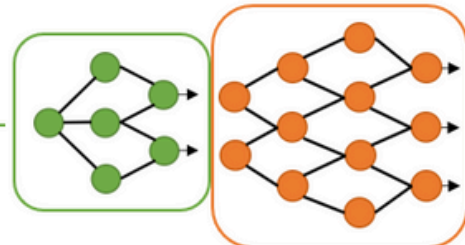


Weights

- Board encoding
- Observation encoding
- Siamese Network



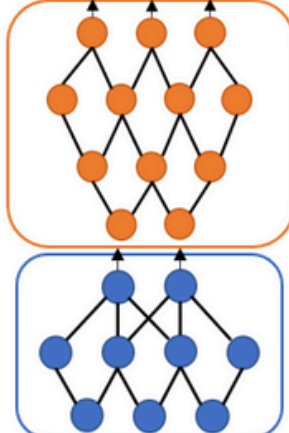
True board



Set of wrong boards



Sample wrong board

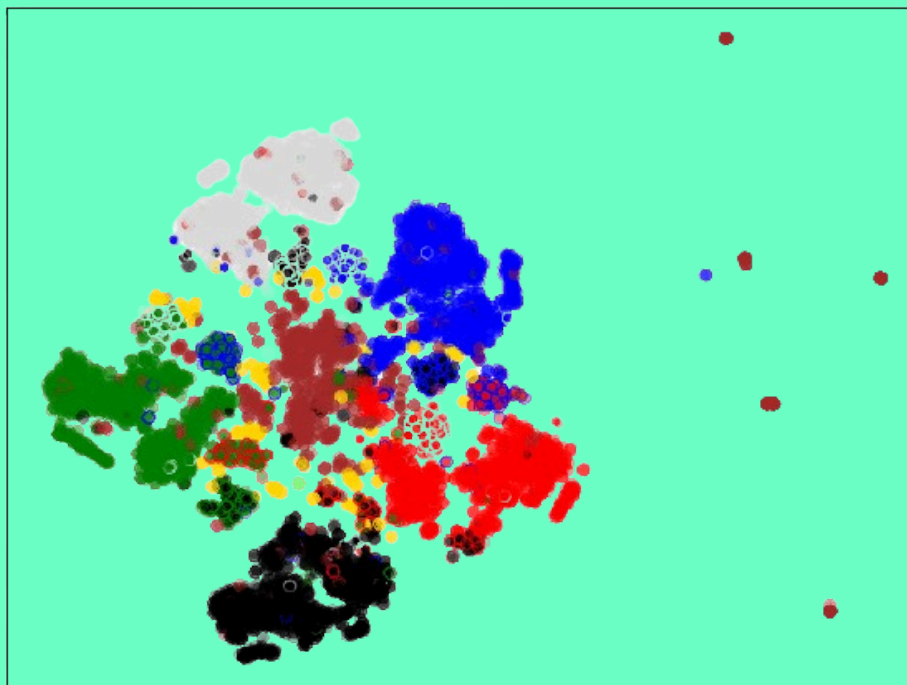


Observations		Opponent: Trout			Color: White	
Sense ---- :	No capture	Sense c7 :	No capture	Sense f5 :	No capture	Sense d6 :
Move e3 : ✓		Move c4 : ✓		Move Nf3: ✓		

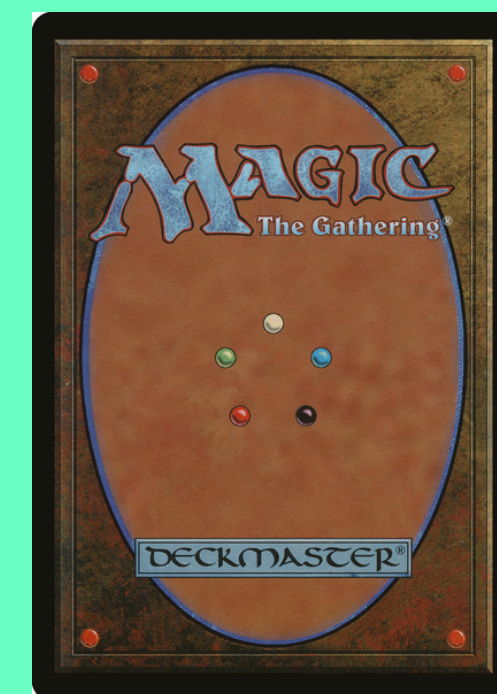
Preferences > Predictions



Meaningful embedding



Versatile





THANK YOU!

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