RobertTLange

@TUBerlin

@RobertTLange

Visual-ML-Notes

@Sprekelerlab

@ECNBerlin

@SCIOI

@forAI_ML

visual-ml-notes.github.io

Apps

GALLERY ABOUT

VISUAL•ML

A Collection of Machine Learning Notes

a little bit of sience - a little bit of art

T. Graepel (DeepMind): 'Automatic Curricula in Deep MARL'

HEIDER & SIMMEL [1934]

SOCIAL INSTINCTS HARD-WIRED

INTELLIGENCE ⇒ $\Upsilon(\pi) := \sum_{\mu \in E} 2^{-K(\mu)} V_\mu^\pi$

MEASURE — SET OF ENVS — COMPLEXITY WEIGHT

↳ MULTI-AGENT IMPORTANCE: APPLICATIONS, ARCHITECTURES, ⊕ AUTO-CURRICULA!

↳ WHO IS REALLY INTELLIGENT? ⇒ CIVILISATION? ⇒ COMPANY AS NECESSARY INGREDIENT!

PROBLEM-PROBLEM ⇔ AUTO-CURRICULA

- COMPETITION
  - OTHER SPECIES
  - OTHER TRIBES
  - OTHER INDIVS
- COOPERATION
  - HUNT / SHARE
  - LEARN
  - CULTURE/LANG.

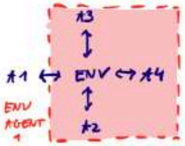
WHAT MAKES A RICH LEARNING ENV? ⇒ MARL

1. AGENT EXPERIENCES OTHER A'S AS PART OF ENV DYNAM.
2. DYNAMICS ARE NON-STAT. ⇐ OTHERS LEARN
3. OTHER AGENT'S LEARNING = NEW TRAINING TASK

SOCIAL INTELLIGENCE HYPOTH.

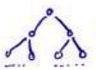
SOCIAL COMPLEXITY = KEY SELECTION PRESSURE DUNBAR 07'

AUTO-CURRICULA THROUGH MULTI-AGENT RL



- EXPLORE BY EXPLOIT → PUSHED INTO
- DIVERSE POPULATION → COVER SPACE
- SKILL-BASED MATCH MAKING → BALANCE FOR ROBUSTNESS

① ALPHA ZERO



- 2 PLAYERS
- 0-SUM
- PERF. INFO

→ POLICY NET: BREADTH ↓
→ VALUE NET: DEPTH ↓

P,V / P',V' → SELF-PLAY DATA COLL. ⇒ LESS SEARCH

② CAPTURE-THE-FLAG

- 2 TEAMS
- 0-SUM
- PARTIAL INFO

→ PBT + PROCEDURAL GEN.

DIVERSITY → META-OPT. HYPERPARAMETERS

→ 2 TIME-SCALE RNN!

→ tSNE ⇒ INTERNAL REPR.

③ SOCIAL DILEMMAS

- N PLAYERS
- MIXED MOTIVE
- PARTIAL INFO

→ SD = TIPPING POINT SELFISHN.
↳ STABLE COOPER. EMERGENCE

→ COMMON POOL RESSOURCES

→ EMERGENT SOCIAL OUTCOMES!

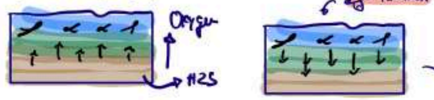
1 of 1

D. Bierbach (HU Berlin): Robofish - A Biomimetic fish-like robot for the study of collective behavior

WHY / HOW DO ANIMALS PERFORM COLLECTIVE BEHAVIOR?

FUNCTION: COPE W. PREDATOR → ① DILUSION OF RISK → ② ENHANCED VIGILANCE → ③ PREDATOR DETERRANCE

Mexico System — Poecilia Sulphuria



EFFECT: WHY?! ESCAPE SUCCESS ✗, ATTACK FREQ. ↓ ✓

SYNCHRONIZED DIVING BEHAVIOR AFTER BIRD ATTACK

TOP-VIEW!

COUZIN ET AL. 02' ZONE-BASED M.

COLLECTIVES ⇐ INDIVIDUALS
↳ PROBLEM OF HETEROGENEITY
⇒ NOT EASY TO CONTROL!

OBSERV. IS NOT ENOUGH ⇒ NEED MANIPULATION

HOW?!

ROBO-FISH
- 3D printed
- Glass eyes

↳ CRUCIAL FOR ACCEPTANCE

OPEN LOOP — CLOSED LOOP → ADAPT INTERACTION RULES ON THE FLY

→ Path following
↳ Lukas et al. 20'

→ Indiv. differences
↳ Consistent over time
↳ Bierbach et al. 18'

APPROACH MODEL ← ZONE BASED
↓
LEAD MODE

↳ INDIV. DIFF. IN HOW OFTEN TO APPROACH

APPROACH: FIXED, RANDOM, COMPETENT

ADAPTION IS KEY ⇐ INTEGRATE REACTION EVIDENCE

↳ SIGNIFICANTLY FASTER LEADERSHIP!

1 von 1

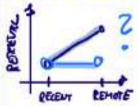
A. Saxe (U of Ox): 'A Normative Theory of How Hippocampal-Neocortical Interactions Consolidate Memory'

MEMORY: DEC. / NON-DEC. — HERE!

STANDARD: HIPPOCAMPUS —TIME→ NEOCORTEX

PROPOSAL: ←→ PREDICTABILITY

GRADED VS. FLAT



MULTIPLE TRACE THEORY DISPUTE ↓ MECHANISMS?

STUDENT-TEACHER + NOTEBOOK SETUP

T1 → T2

S1 → S2, NB

TEACHER / ENV ⇒ GEN. MODEL ⇒ LINEAR NET → SGD

STUDENT → 'NEOCORTEX' ⇒ SLOW ⇒ LINEAR NET → SGD

NOTEBOOK → 'HIPPOCAMPUS' ⇒ FAST ⇒ HOPFIELD → ONE-SHOT MEM.

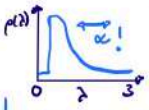
① REPLAY W. ∇ LEARNING [BATCH GD]

$\alpha = \frac{\#\ \text{SAMPLES}}{\#\ \text{PARAMS}}$

DYNAMICS: FORGET INIT / OVERFIT NOISE

DEPENDS ON λ DISTR. ⇒ GAUSSIAN W

MARCHENKO-PASTUR



↳ WORST CASE: α = 0

② ONLINE ∇ LEARNING

DYNAMICS: FORGET INIT / WANDER NEAR MIN.

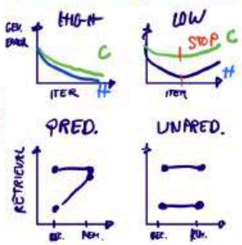
CAN'T OVERFIT
↳ each point new!
↳ create 'wiggle'

③ LEARNING VIA MEMORIZATION

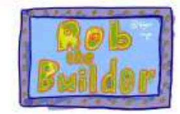
NEAREST NEIGHB.
↳ FAILS IN HIGH-D.

↳ HEBBIAN L. INTERFERENCE

PREDICTABILITY OF ENV

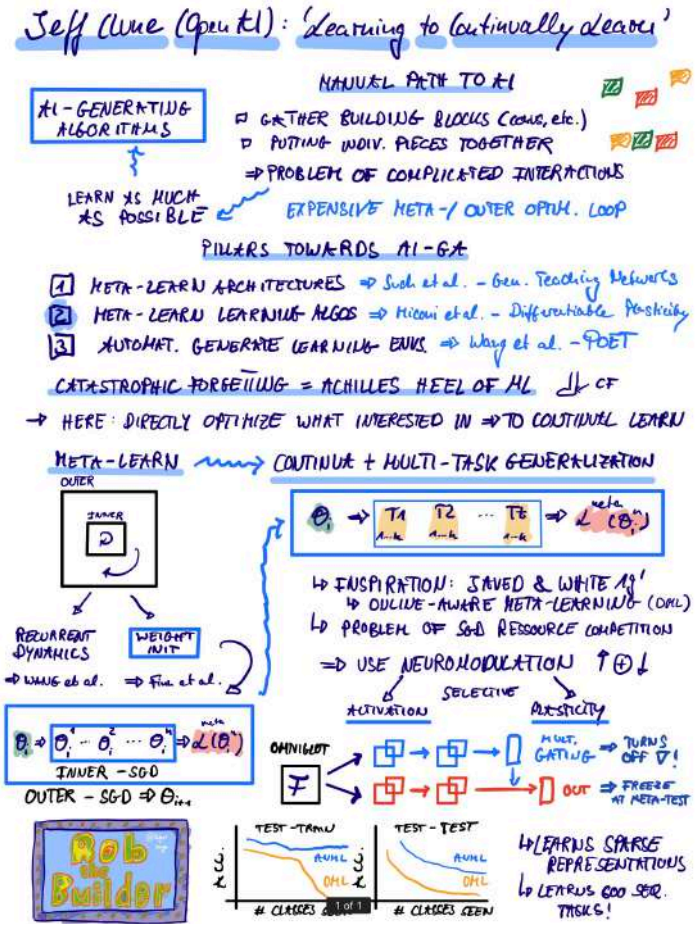


⇒ REPLAY ONLY WHEN IT HELPS TO GENERALIZE



1 von 1

The Emergence of a Sketch Note



iPad Pro 12.9'

Notability/GoodNotes

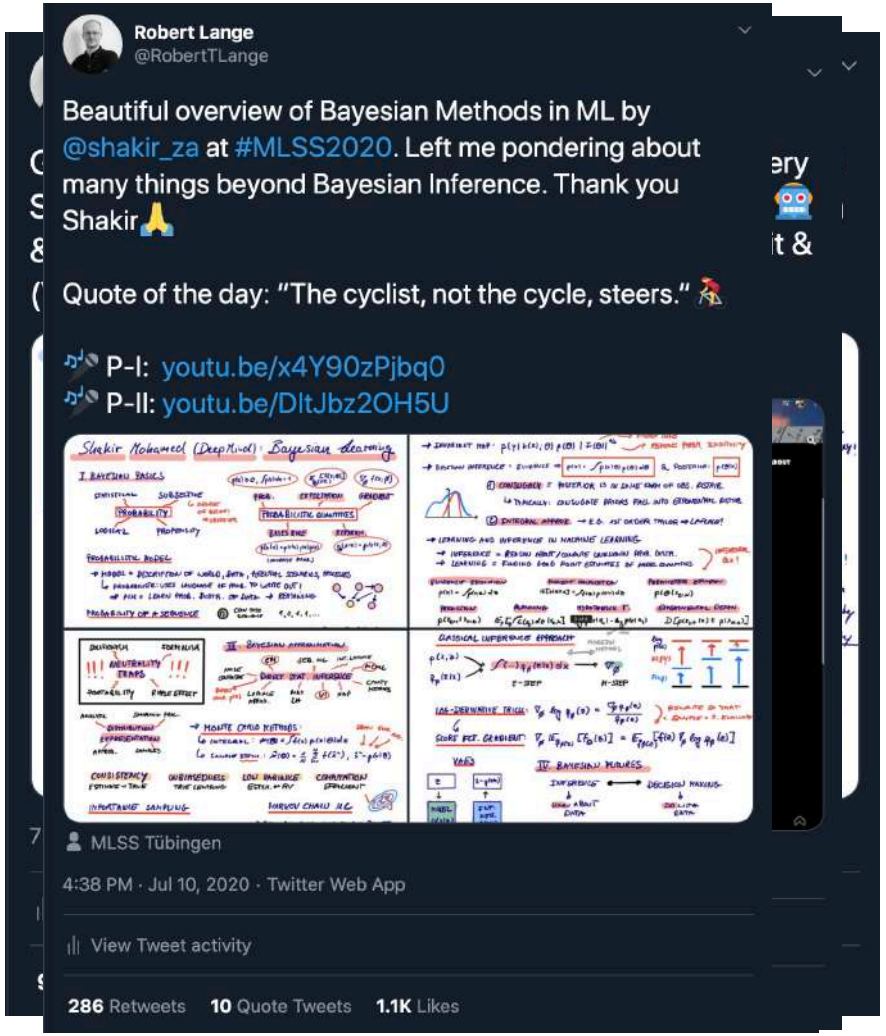
One theme color

Put your name on it

Iterate & find your style

A Timeline of how I got started...

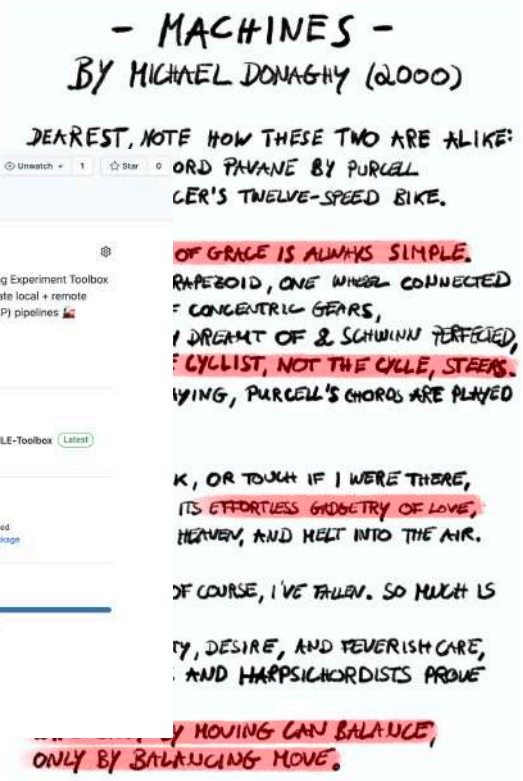
- 10/2019 — My 1st note.
- 12/2019 — NeurIPS euphoria.
- 12/2019 — GitHub repository.
- 05/2020 — Website Launch.
- 07/2020 — Cracking 1000 Likes.



You can combine sketching with anything...

Blogposts

Poems



Sketch Notes

Notability

Thumbnails

Procreate

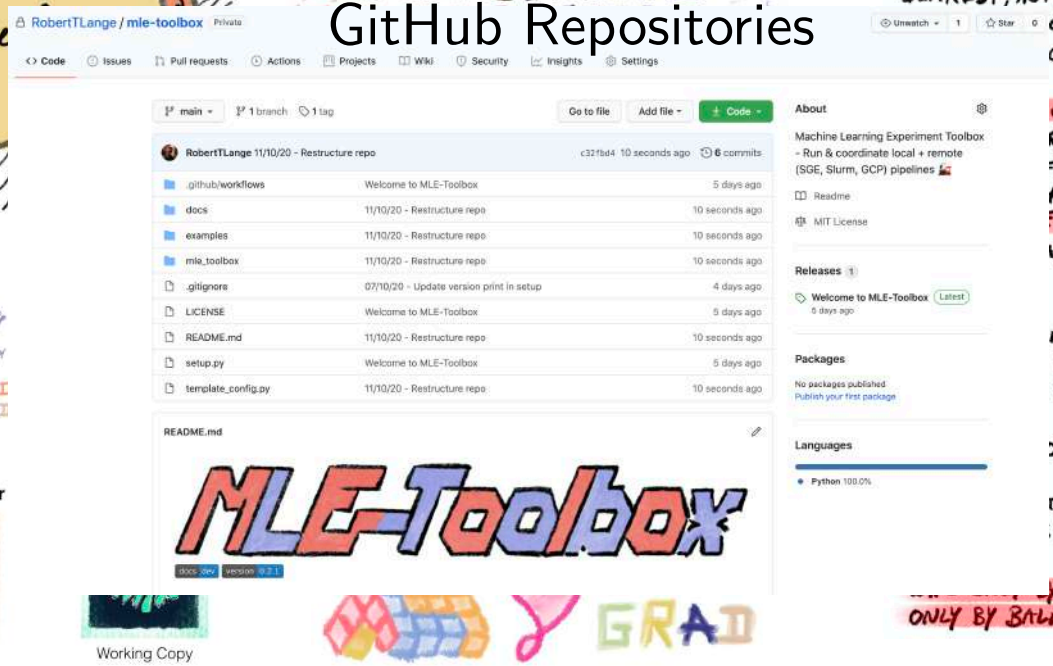
Blogs/Mini-Projects

Raspberry Pi 4B

Remote Jupyter

Juno Connect

GitHub Repositories



Working Copy

A Couple of Personal Takeaways

1. Use your PhD to build your brand.
2. You need a Twitter account.
3. The iPad is an awesome investment.
4. Positive energy attracts positivity.
5. Be individual and consistent.