Halite by Two Sigma

# Abstract

In this competition, Kaggle offers a SDK (Software Development Kit) in order to help writing the code easily.

Two types of models: heuristics or reinforcement learning

One thing that concerns me about this competition is that the performance of your agent is not seen immediately. The agent needs to play games that will match with agents in the same ranking position. So it can take weeks in order to see your agent in the top. Wrong. I have submitted a bot and it goes to the actual position in less than a day.

<https://openai.com/blog/openai-baselines-ppo/#ppo>

Proximal Policy Optimisation is state of the art in deep reinforcement learning with a lot of simplicity. There are other interesting algorithms, you can find more on Stable baselines library.

OpenAI gym provides environments.

Stable baselines provide algorithms.

OpenAI Spinning Up is cool

<https://spinningup.openai.com/en/latest/user/introduction.html>

# Optimal mining

<https://www.kaggle.com/solverworld/optimal-mining>

<https://www.kaggle.com/solverworld/optimal-mining-with-carried-halite>

<https://www.kaggle.com/solverworld/optimus-mine-agent>

<https://www.kaggle.com/shirakia/optimus-mine-agent-best-ship-for-sy-1000-score>

We will work out how to compare going to various cells containing halite and determine which is the optimal one to go to.

In the first notebook, the approach is pretty shitty, we just stay more turns mining if we took more time to get there, ie distance travel is higher. Then we compute the score based on the halite per turn. So we will only go to cells that are far away if the halite is high so it compensates halite / turns.

I don’t agree about staying only a few turns mining if it is close. But it can help in the cases where we are creating ships. Otherwise the ships cannot move from the shipyard. Well but if we go to the shipyard to return the score we will not be able to create ships either.

In the second approach, now is consider the carried halite. But wtf it is summing it on the numerator, ie the more halite carries the higher the score. Well exactly, the higher C the score will be higher with few turns, then we will stay very few turns mining.

I think we can optimise the matix.

* Take into account clusters.

### Improvements:

* I should not only take into account halite cells, but clusters of halite.
* Tune compute max ships based on halite left board.
* When attacking ships, attack the one with more cargo?
* Attack more far away than shipyards could be beneficial in order to not let others farm. Notice that if you don't attack enemy’s ships in cells with a lot of halite, they will farm easily. However I should avoid having ships with a lot of halite far from my shipyard. They usually get killed. But if I do, it should only be by using ships with 0 halite.

VERSION 5:

* Regulate max ships in last turns.
* Distance to attack an enemy ship must be < 2, ie 1. Otherwise don’t follow.
* Change score to convert into shipyard if other shipyards around.
* Limit 300 to convert to shipyard.
* Bug: If the player finds a big halite spot but there is a ship that can destroy him in the next turn, it will not go to take the halite and it will freeze in that position in order to not let the enemy take it. Ideally we should send a ship with 0 halite to take that halite. But it can be quite complicated to code. I don’t expect this to happen playing against other players. Even if it happens, penalize both players so it is not that bad.

VERSION 12

* In the last turns, collide own ships to collect halite into the shipyards.
* Change values for attacking ships. More value and d1 < 3.
* Only attack if d2 (shipyard distance) < 4. (not working here yet)
* Max ship to 60.

VERSION 15:

* Assign negative value for staying in a shipyard cell.
* Ship follows enemy d2 (shipyard distance) from 4 to 6.
* Solve problem attack matrix (this is not well solved - worse score)

VERSION 16:

* Attack matrix fixed. Now should not follow ships.
* Not avoid attacking enemy’s shipyards.
* Shipyard limit from 7 to 6.
* Create attack shipyard matrix.
* Avoid creating shipyards if distance is less than 4.

VERSION 17:

* Change mechanism of attacking shipyards, we only go if halite 0 or less than 100 d1 < 3.
* In the last turns, don’t go all in for shipyards. Just increase the value a little.
* Be careful when attacking a ship. We are adding too much value, in that case, several ships (the ones that satisfy the conditions) start following it because it has the highest value of C but they do not actually mine.
* Only attack if d2 (shipyard distance) < 4 and d1 < 2.

VERSION 19:

* Add avoid crashing to the shipyard if the player has less than 10 ships.
* Only attack if d1 < 3.
* More separation among shipyards d < from 4 to 6.
* Change the max number of ships evolution to avoid creating ships at the end of the game.
* Do not create shipyards later than 200 turns (before was 300).

VERSION 27

* -= 30 / d to create a shipyard around (in order to create more, otherwise we are creating around 2-3) (after we create around 3-4 and better results).
* Fix problem Iterate over all cells, i.e. compute the C matrix for all cells for all ships.
  + The shipyard attack was unable to work so far because we were not iterating over the points where there were other shipyards.
  + Actually the ship attack was not working either.
* Still halite\_min = 50. The only difference in the mining is that now we add 0 value to cells with halite less than 0 instead of not having any value. This should have benefits.
* I discovered how to print the logs!
* Added get player\_max\_halite and player\_max\_ships.
* Avoidance matrix shipyard based on that.
* Attack shipyards based on that (attack only if max ships or max haite)
* The problem of attacking shipyards with ships with halte different than zero is that if he creates a ship in that turn, u will lose the ship. So u should only attack with halite > 0 if the player has less than 500 halite. Otherwise attack because it may happen that u attack and there is a ship depositing with more halite than u so u kill the ship and the shipyard and avoid the deposit of halite.
* The shipyard attack is working fine now.
* I will have to play with the values with different submissions. Maybe right now it is too aggressive.
* Update max halite player to consider also sum of ships halite.
* Modify my attack score by only attacking ships where their cell has halite > min, because if their cell doesn’t have score, they are probably thinking to move (tmp position). Apply in both matrix and target score.
* Modify function last 390 rounds, we can only add high value if d1 between ship and another ship is 1.
* (No) Create a matrix to avoid staying in a fixed place if an enemy ship next to me with less halite. We check if we have any enemy ship close with d1=1 and less halite than us. If this is the case we store the positon of our ship in a matrix in order to avoid any action that leads to stay in that position.
* (No) Also remove convolution in avoid matrix, the avoidance positions it was returning doesn’t make sense to me.
* Precisely, the convolution what it does is converting to avoid the 4 positions where the enemy ship can move, so it doesn’t kill u in the next turn. Removing it cause the results to go down.

VERSION 33

* Deactivate some things to see if they are making the results worse.
* (fixed) I lose a lot of ships due to not being able to move because all positions are in avoidance (enemy ships around). In that case the ship stays and doesn't move. It is better to move to some place rather than staying! Usually it can save ur life, but if u stay u are dead for sure.
* Still I lose some ships that could have been saved:
  + (solved) Blocked position, jumps to position where we already have a ship that has taken that position in the current turn.
  + (solved) Ship stays in a cell with 0 halite, when an enemy ship was following him. I have seen it several times, always happens when it is in a cell with 0 halite. It looks like i have introduced an important bug here. What happens here is that the ship next action is convert but since it is dangerous to do it, it doesn't do it, but then the action is not assigned and stays in position. Then gets killed.
* Sad to say but we need to reduce n of max ships otherwise timeout per turn (6s max).

VERSION 34

* When no positions left because all actions fall in avoidance, instead of recovering the actions that gets us close to the target score, we should prioratize cells with 0 halite or moving to position where there was an enemy (since he probably will move). They have more chances to survive.
* I expect very similar results than version 33. Because after seeing the replays, they get killed as well, there is a bit of a randomness there that u cannot control.
* This version seems to work better than version 33.

VERSION 36

* (No) Auto destroyment ships: take into account that we record the next actions of the ship in order to avoid overlapping actions. Even if we put a high score, they will not collide because of that. The solution should be not ask for this restriction in the last turns, and make the ship with 0 halite stay in the shipyard and make the other ships collide on him. So ships will get destroyed but the halite will not be loosed, then the remaining ship of the shipyard position will take all the accumulated halite and store it (collision before deposit). Top performers trigger this at turn 395.
* Activate attack to shipyards again.
  + Play with the values.
  + (good) The matrix for attacking shipyards, attacks if ship.halite == 0 or only attacks if players have less than 500 halite so he cannot spawn new ships if ship.haite != 0.
  + When attacking shipyards with ships with 0 halite, i should not care about avoidance cells from possible attack. Otherwise I will never reach the shipyard. Solved by removing avoidance cells when my\_ship halite and enemy\_ship\_halite are equal.
  + In the last 300 turns attack only the player with more halite, not the one with more ships.

VERSION 41

* Improve creation of shipyards.
* Divide shipyard creation between before having 2 shipyards and after.
* Create shipyards at 6-7 distance from another shipyard (from elite)
* Create max shipyards to 4
* Max 3 if the turn is between 200 and 300.
* Num constraint to create shipyard n.ships > 4 + num.shipyards\*5 (based on elite)
* ###########
* Improve attack shipyard wrt v36.
* I have discovered that the turn order is ship collisions < shipyard collisions < halite deposit. So if the enemy create a ship when we are attacking with a 0 halite ship, both ships will be destroyed but not the shipyard. If that happens, sending a ship with 0 halite there would have not been worth it.
* People may have a mechanism to create ships if some enemy ship is at d == 1 as long as they do not have another ship there already.
* People may have a mechanism to avoid depositing if some enemy ship can move to the shipyard next turn (almost everyone has this)
* Conclusion: I should always attack when halite’s player < 500 (as we already have) then don’t attack in the other case.
* Only add value if we are at < 3 distance from a shipyard enemy and he has less than 500 halite.

VERSION 43

* Implement mechanism defense of shipyards. Create a ship if some enemy ship is at d == 1 as long as we don’t have another ship there already.

VERSION 46

* Solve bugs v43 y 41:
  + Limit n of ships to create to defend, i don’t want to end with more than 40 ships.
  + I have introduced a super weird bug in v 41. Where the ships gather on the right side of the board doing nothing. The why is because they target a cell with reward 0, because there is no other action with more reward.
  + Create third shipyard only if more than 20 ships. Limit 4 shipyards is still ok.
  + **Actually it may be that the attack on shipyards was actually good. Because it was in v36. Maybe the shipyard mechanism is not good because they are super close together.**
* #############
* Improve the attack on ships. So far we are killing very few ships or even 0.
* Remove condition not attacking if enemy in cell with 0 halite. In v27 we added Modify my attack score by only attacking ships where their cell has halite > min, because if their cell doesn’t have score, they are probably thinking to move (tmp position). Apply in both matrix and target score. I am not super sure about this because, if the enemy ship may be escaping so that’s why it is in a cell with 0 halite. In that case, not attacking can determinant to not caught him.
* ATTACK\_MIN\_DISTANCE\_SHIP = 5 (before 3)
* ATTACK\_SEPARATION\_SHPIPYARDS = 6 (before 6)
* Ships with 0 halite gets destroyed super quickly because of not avoiding attacks shipswith the same halite. This condition may be good if other contricants don’t have it, otherwise, it is fucked up because, u both auto destroy ships and u end up losing yes or yes then. This happens mainly in the first turns. I see two options:
  + (done) Remove the condition to attack if equal halite in all rounds.
  + Or remove condition only in the first rounds.
  + Notice that top performers avoid these crashes.

VERSION 47

* As we mentioned in V46, if we have more than 25 ships, remove the condition of avoiding enemy ship positions.

VERSION 48

* Increase distance between shipyards. They are definitely too close now.
* Once u have more than 9 ships, to create a shipyard or a ship ask for having 1000 halite instead of 500, so u always have some in reserve to protect shipyard. If we implement this, we may not need to have shipyards close to each other. Since they are autodefendable.

Best versions so far 46 > 48 > 47 36 33 34 good as well.

VERSION 49

* Remove v47 (was decreasing results)
* Make shipyards closer, otherwise cannot defend my cells, other ships stole from me.
* I think I should kill shipyards close to me since they will fuck my mining.
* I think I should enable the attack on shipyards again.
* I think I should add more value to attack, so they don’t steal my farm.

Improve halte recollection.

* Notice this rule: Halite Regeneration
  + Every cell on the board that has more than 0 halite and no ships on top of it will now regenerate by 2% of the existing amount of halite in the cell. Halite can grow up to a maximum of 500 halite per cell.
* So the idea will be to modify HALITE\_MIN based on the turn or n of ships.
* During the first turns ti can be halite\_min 100
* Once we reach 20 ships put halite\_min 300
* During turns 200 and 300 halite\_min 400
* Turn 300 halite\_min 30

VERSION 50

* Enable the attack on shipyards again, ie attack of v36 where we attack with ships with halite == 0 despite the distance.
* Not avoid attacking shipyards that are not from winning players, since we want to destroy shipyards that are close to our base.

VERSION 51

* More value to attack ships.

51 > 46 > 36 > 50 > 49 > 48 > 47

VERSION 52

* Since I am not mining always because I want to accumulate halite, my ships do not have any action. The best thing I can do here is to do a random movement without staying still. I think I can impose this if I remove cells with reward 0, i.e. going back to what i had before.
* I may have to restore what we had before avoid the points to assign targets because i am worried about memory errors (happening).
* Add cells above halite\_min, then add cells where there are ships, then add cells where there are shipyards. Finally remove duplicates of the list of points. I think it is ok to do a random movement instead of trying to do sth else.
* What I expect with this fix to happen is the following: shipyard deposit, then reward around 0, so random movement, as a consequence, it stays super close to the shipyard, so it helps defend it.
* Solved the bug of having ships without doing anything.

VERSION 53

* Destroy only shipyards that are close to my shipyards or if they are from the best player. Apart from the other conditions that we already had.

###############

Try to imitate convex player. It seems that at the beginning it farm at halite\_min 50 until he has 20 ships. Once he has 20 ships he seems to attack very far away from the shipyard:

* + Once he has 20 ships he starts attacking a lot and bothering pretty far away, and he barely mines, not create ships.
  + At turn 300 starts recollecting at halite-min 30 or so.
  + If my ships go so far away I cannot defend halite.
  + If I do not recollect halite for a long time, i cannot defend my shipyards.

############

VERSION 57

* (done) Case assign target if ally ship. I think I should reduce score if there is a ship in a cell with min halite (or even without min halte). Because otherwise, we the ship may find that cell with a high value if it has high halite, when there is already another ship mining it. Solved by putting cell score to zero if we already have a ship there.

VERSION 59

* In this version we are going to look closer at how we mine halite.
* Change reward function:
  + The more halite I carry, the less reward I want to have by mining since i prefer to go to the shipyard.
  + On the other hand, if I have very little halite, I want to mine.
  + I want to go to the cells with more halite, taking into account the distance
  + Not drop the score so drastically when carrying halite is higher. The most relevant parameter should be the distance, in the sense i should add a high score if the distance is lower even if i have high halite.
* Conclusion: after changing the reward function, the results get way worse.
* Strangely enough, my reward cost function doesn’t work. Don’t know why though. The previous function was doing the following:
  + It gives worse score if cell more far away (this is the same)
  + The more halite I carry, the more reward we add to a cell, I think it works better because in in this way we are able to gather all halite in certain ships and have ships with 0 halite to attack.

VERSION 60

* Restore reward function
* Do sth against ships with 0 halite. Now we give reward for attacking ships with 0 halite.
* Implement dynamic halite min.
* Conclusion: dynamic halite is not working.

VERSION 61

* Restore v57
* Do sth against ships with 0 halite. Now we give reward for attacking ships with 0 halite. Wait but I I forgot sth and the ships with 0 halite were not attacking.
* Dynamic halite\_min deactivated.
* More attack + 2000

Things that can be improved:

* I think that the attack to shipyards in the last round should be even more aggressive, since it can cause the other player to have to create shipyards.
* The reward function is good, better not to change it. But need to do sth with the halite\_min.
* I have seen creating shipyards in cells with halite != 0. I should clearly avoid this and create the shipyard in places where i have more cells with halite != 0 at d < 2.

### Analysis top players:

<https://www.kaggle.com/c/halite/discussion/175413>

<https://www.kaggle.com/huiunited/game-commentary>

* Also makes phases clear: 1-10 (launch), 10-80 (establish position), 80-280 (own the battlefield), 280-380 (gain reward), 380-400 (close down). It makes me wonder if the step 280 strategy change can come at an earlier step.
* One of the the strategies of some of Kha & Dan & Gilles submissions appears to be to park ships right outside your shipyards if you let them. That can be very frustrating if you are not expectin.

VERSION 62

* Create phases: expand, hunt and gain reward.
* I add more value to attack if we are in the hunting phase and we have more than 20 ships.
* Now the attack on ships with halite 0 works well.

VERSION 63

* Create more shipyards and ships, so I can cover more areas. 50 and 6.
* Delay gain reward phase.
* Limit of attacking > 15 ships, otherwise if we do not arrive to the limit we lose the game.

VERSION 64

* There is a problem, if I destroy the enemies in a way that they are no longer entering my shipyard, the attack target is not triggered so I end up mining my cells. Then the recollecting gets messed up because the halite no longer regenerates enough. In such a case I should go and find another zone. That’s why I think I should not put limits on shipyard creation.
* Change the creation of shipyards. Added option 2.
* The problem of option 2 is that if the enemy attacks a lot the shipyards, i will not be able to defend them.

VERSION 66

* Do not ask for round 80 to start hunting, ask for 15 ships.
* Keep attacking a little bit after gain reward step.
* Implement sth to be able to attack ships with 0 halite if they are closer than d < 3 shipyard. Now we are avoiding them in the avoidance matrix. Done.
* Add option 3 which is the v36 one for creation of shipyards.
* Keep option 2.

Submissions 66 64 give me super good results. 66 > 64.

VERSION 67

* Option 1 but well done, being able to create more shipyards and more distant. In this way I should be able to defend better the shipyards and also attack better if someone enters my zone.
* This was not well computed, so that’s why it was working worse.

VERSION 68

* Check how pros defend shipyards, maybe my strategy is not good because i sacrifice creating one more ship in the beginning of the game, which is super important. Also I don’t see anyone doing it. What I am seeing is that if there is one enemy ship close, they send the nearest ally ship to the shipyard targeted. As long as they can arrive earlier than the enemy.
* Remember that shipyard collision happens before depositing, so if I send some ship to defend, I need to give him at least 1 turn extra to deposit.
* How do we combine this with spawning ships? Spawn should happen first, if we cannot spawn then we move to the shipyard to defend. If we try to spawn we move or ship from there.
* We first move ships and then spawn if turn.position not taken.
* Change requirement back to 500 instead of 1000.
* Change creation first shipyard. Do not ask for halite != 0. We want to create it fast and in the best position.
* Option 1 was not well done in VERSION 67. That’s why it was probably working badly.
* Also we have improved the creation of the first shipyard so we can create it quickly and in the zone with more halite.
* For the creation of shipard ask for 1000 halite, Ideally, we want to create it and next turn spawn a ship from there. otherwise it can be destroyed next turn. We achieve this by setting a num of max ships if we have less than the number of shipyards we should have. Therefore we do not create ships until we have 1000 of halite and we can create the shipyard.
* Remove attack in the gain reward phase. Otherwise we attack instead of mining. Maybe v66 and v67 were working worse because of that.

VERSION 70

* Maybe I need more ships before creating so many shipyards. 20 ships for 3 is ok. But 20 ships for 4 is not enough. I have changed the rules asking more ships: 25 for 4, 30 for 5, 35 for 6...

VERSION 71

* STEP\_START\_GAIN\_REWARD = 300 (before 340)
* Working worse because I am creating ships until the very end of the game. As a consequence, the halite I mine is being used to create ships. Needs to be fixed.

Analysis results:

VERSION 70 >> 67 > 71 > 68

* I have really good results for 70, but not for the others.
* Given the decrease in results by version 68 wrt 67, I think the main cause is the change of defense in shipyards. The new defense works well but I think it is way better than the previous one. In the new version we have a ship still in the shipyard most of the time without doing anything, every time an enemy is close, we need to move the ship towards the shipyard. We can miss an attack due to that or we can lose a lot of farm.
* (solved) I keep creating ships until the very end of the game. Sth broken here. This is because I have broken the max ship configuration after hard coding the max num of ships.

VERSION 75

* When someone is attacking my ship, my ship sometimes runs in direction contrary to my shipyards. Why? If actions towards the target have been invalidated due to avoidance cells, then we check other actions. Now we have added a shuffling to the list of all other actions in order to not always prioritize one direction.
* I keep creating ships until the very end of the game. Sth broken here. This is because I have broken the max ship configuration after hard coding the max num of ships. Fixed.
* I need to improve the creation of the first shipyard. It cannot be possible that I create the shipyard in some place where there is no halite at all.

VERSION 77

* The matches I lose is because I have less ships than the enemies: As a consequence I cannot control enough space in the board and then I cannot recover from that point.
* This mainly happens not because I do not create enough ships, but because I lost too many. The reasons are:
  + Ships with 0 halite that attack ships with 0 halite around my shipyards.
  + Ships that attack shipyards.
* Solution
  + Only attack ships with 0 halite if d <= 1 from our shipyards.
  + Only attack shipyards if they are d < 3 from our shipyards.
  + Add enemy shipyards as cells to avoid.
  + We keep the attack (give reward to attack) under certain conditions, but we will move there and not destroy the shipyard. This should bother the enemy.
  + Change values to attack shipyards. We were attacking with 25 and 5 ships when round > 340, this is super bad! Because this was clearly affecting our gain reward period.
* I do not like the creation of the first shipyard, in some occasion it takes too long to create it. I need to prioritize speed rather than position. Back to what we had before.
* ships don't move from the shipyard if enemy at d 3. Fixed.

VERSION 79

* Limit the distance ships go away to mine. Otherwise they get killed. I have limit the distance to 7 or less, which matches with the distance to attack inside the shipyards.

ANALYSIS RESULTS

75 > 70 > 71 > 77 > 79

* Seems that the attack to the shipyards is needed, since the results after removing it have decreased a lot.
* I still think that maybe the other method to defend shipyards was giving better results.

VERSION 83

* Reactivate attack on shipyards again: The games where I am most fucked up is when someone creates a shipyard next to me. I have opted for not destroying it since it can take a lot of ships/halite to make it. However, in such case I should try to create a shipyard in another zone with high halite and less populated.
  + Tbh, I think the better I can do is try to destroy them. It may cost me a little but then I will have space to recover. On the other hand, If I do not destroy the shipards that zone is gonna convert in a complete warfare, and no one will be able to farm shit.
* Reactivate my method to defend shipyards. Even a bit improved now.
* Sometimes it takes time to create the 3th or 4th shipyard. We should create ships in the meantime. Fixed.

VERSION 84

* I should try if num of ships 15 and n of rounds 80 is better to start attacking. Actually pros start attacking once they have 20 ships. They do not take care rounds. What i should do is ask for 20 if round <80 and ask for 15 otherwise.
* Remove limit distance mining from shipyards.

ANALYSIS RESULTS

67 > 75 > 70 > 77 > 84 > 83 (pretty bad)

VERSION 85

* Limit distance, at least until you gain reward. In the gain reward increase limit.
* Create the 3th shipyard at 18 ships.
* Attack again to shipyards. Ask for less ships. Before it was impossible to attack.

VERSION 86

* ATTACK\_MIN\_DISTANCE\_SHIP = 3 (instead of 5). This should help to mine more during the hunting phase.

VERSION 88

* Add closing game phase round 390
* Auto destroyment ships: take into account that we record the next actions of the ship in order to avoid overlapping actions. Even if we put a high score, they will not collide because of that. The solution should be not ask for this restriction in the last turns, and make the ship with 0 halite stay in the shipyard and make the other ships collide on him. So ships will get destroyed but the halite will not be loosed, then the remaining ship of the shipyard position will take all the accumulated halite and store it (collision before deposit). Top performers trigger this at turn 390.
* What I see in VERSION 86 is that attacking with 3 can lead to mine too fast on the board. I guess it is better to put 5 but regulate the reward so, if there is a lot to mine, don’t go. Done; I have high expectations.

VERSION 91

* Most of the games I lose are because of creating a shipyard next to other people, I should avoid that.
* Try option 2 (improved) for creating shipyards.

VERSION 92

* Option 2
* Start gaining reward step at 280 not 300.
* if (board.step > 320 and len(me.ships) > 15 but this at turn 300

ANALYSIS RESULTS

75 > 85 > 92 > 86 > 88 > 91 > 77 > 79 > 83

* It is clear that the previous method to defend is better.
* Option 1 seems better than option 2. However I should try option 2 with previous defense method.
* Start gaining reward step at 280 not 300 good.
* if (board.step > 300 and len(me.ships) > 15 good.
* Auto destroyment good
* Attack ships with 3 or 5 but less halite seems not good. Maybe need to keep 5 but a little bit more score.

VERSION 94

* Defend without spawning ships. Just moving ships.
* Option 2 creation shipyards.
* Increase attack ships, 5 + 700.

VERSION 95

* Attack ship. Multiply halite enemy ship and increase distance to 7 and 10. I want to increase importance attack if ship has a lot of halite, in such case i should move a lot of ships there.

VERSION 96

* 5, 8 to attack I think is better than 7 10. But I will keep the score multiplying the halite.
* Option 2 creation shipyards
* Changes in the n of ships to create shipyards
* Added halite min in order to mine gradually.

VERSION 98

* Attack + 2000
* Add min len(ships) to modify halite\_min. Otherwise 50.
* Attack up to 10 distance
* Halite min 30 until 4 shipyard, then attack a lot.

VERSION 99

* Try with option 1 shipyard creation.

# Deep RL

## Ideas

* PPO with CNN training.