Evolučný fuzzy systém pre autonómneho mobilného robota

Ján Spišák

Úvod

- K.S. Senthilkumar
  - College of Arts and Science, King Saud University Wadi Al Dawasir, Riyadh, KSA
- K.K. Bharadwaj
  - School of Computer & Systems Sciences Jawaharlal Nehru University New Delhi, India
- Zdroj: https://ieeexplore.ieee.org/abstract/document/5339649?casa_token=3ylZKhot1IcAAAAA:wb7IBkHuQTq4sOM4oxOVKsRapsUwPl7cKyRtrx_LgmmL38qQhNWbqTALmQFYSEE2v3zHn-vPynP0

Popis riešenej úlohy

- Navigácia robota v rámci skladu bez zásahu človeka
- Nájdenie najkratšej cesty z bodu A do bodu B

na mriežkovej mape

- Následne EFS určí cestu,

ktorou sa robot dostane do cieľa

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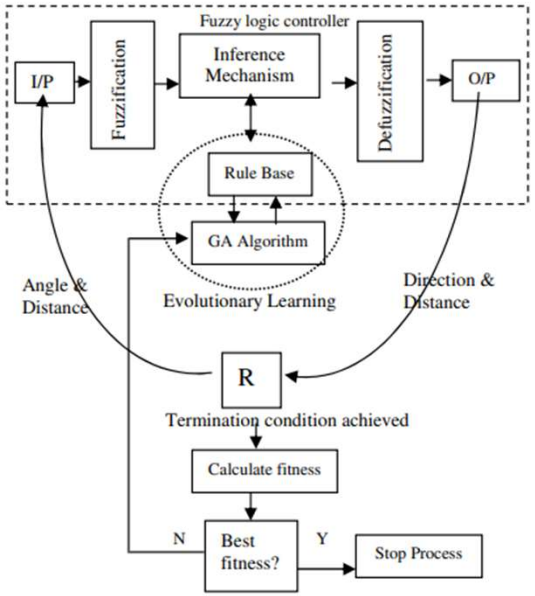
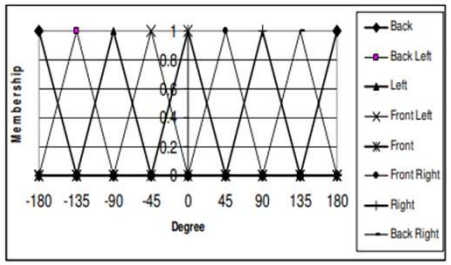
Evolučný algoritmus



- Použitý pre evolúciu fuzzy pravidiel

1. Inicializácia populácie (20 jedincov)
2. Simulácia s aktuálnou sadou pravidiel
3. Zisti či sme došli do cieľa
4. Ohodnotenie pravidiel podľa ich aktivácie
5. Selekcia 6 najlepších/najpoužívaných pravidiel
6. 6 najlepší sa následne kríži medzi sebou (výmena genetického páru)
7. Pri zvyšných 14 sa použije náhodná mutácia pre tvorbu nových pravidiel
8. Opakujeme od riadku 2, kým nedôjdeme do cieľa

Reprezentácia populácie



Variable	Target Angle	Dist 1	Turning Angle	Dist 2	Direction	Dist3
Position	1	2	3	4	5	6

Condition part — Action part

If Target Angle is Front **And** Movable Distance is Far **Then** Desired Direction is Front **And** Desired distance is Far

If Target Angle is Back and Movable Distance is Near **Then** Desired Direction is Back and Desired distance is Near

Angle	B	BL	L	FL	F	RL	R	BR
Value	0	1	2	3	4	5	6	7

Distance	VN	N	M	F
Value	0	1	2	3

If (Target Angle is Front, Movable Distance is Very Near) **And** (Turning Angle is Front Right, Movable Distance is Far) **Then** (Desired Direction is Front Right and Desired Distance is Far)

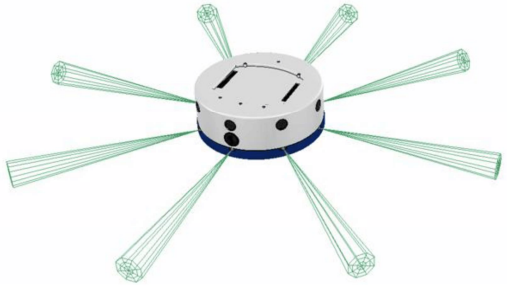
If (Target Angle is Right, Movable Distance is Very Near) **And** (Turning Angle is Back Right, Movable Distance is Near) **Then** (Desired Direction is Back Right and Desired Distance is Near)

- Príklad jedincov:
  - ([4,1,4,1],1)
  - ([6,0,2,3,2,3],1)

Simulácia a ohodnotenie pravidiel

- Simulácia – použitie pravidiel pre navigovanie robota
- Končí keď sa nám neaktivuje ani jedno pravidlo
- Vhodnosť celej sady:
  - $Fitness = A - S + (G * 5) - (R * 5)$

(a)



(b)

Where
A – Allowed maximum number of steps the robot can move during an episode.
S – The number of Steps used by the robot to reach the target
G – Assign 1 for G, if the goal is achieved, other wise –1.
R– Remaining distance from the current position of the Robot to the target position.
Remaining distance, R is calculated by using the formula as in (3).

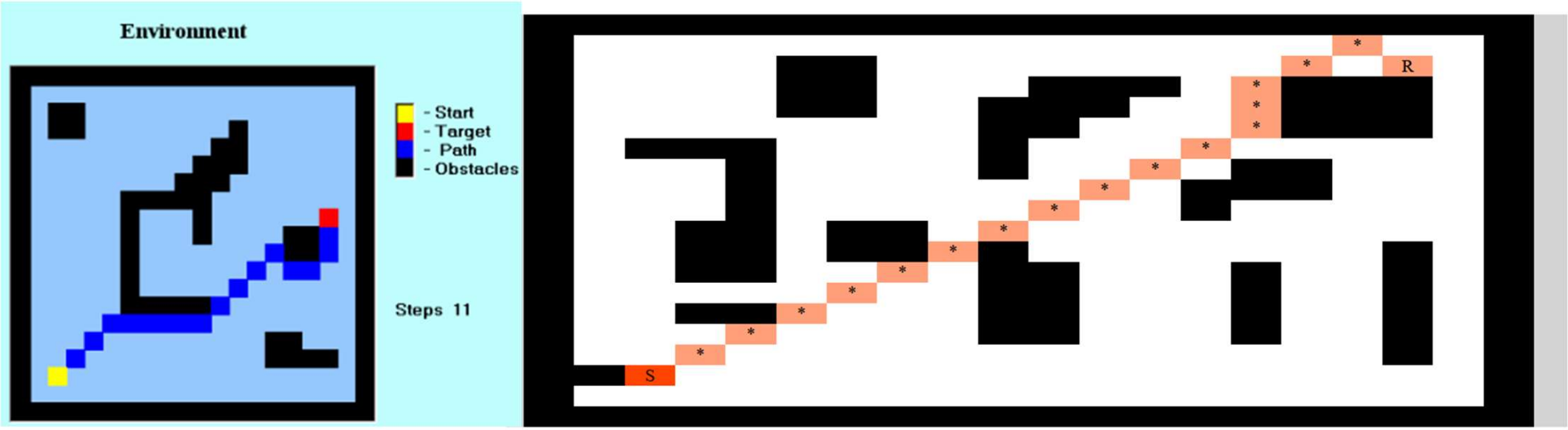
R = Remaining distance / Total distance * 100 (3)

Individual fitness = Number of time a rule is fired / total number of rules fired * 100 (4)

Selekcia a genetické operátory

- Elitistická selekcia – 6 najlepších
- Následne 6 najlepší sa krížia medzi sebou aby vytvorili novú kombináciu 6 pravidiel
- Zvyšných 14 prejde náhodnou mutáciou
- Ohraničenie: 192 možných kombinácií
- Prvý typ 8*3 = 24 pravidiel
  - 8 smerov a 3 stavy: Near, Medium, Far (1-6 krokov voľno)
- Druhý typ 8*7*3 = 168
  - 8 smerov pre stav Very near(prekážka v smere cieľa)
  - 7 možných smerov pre obídenie prekážky s krokom(1-6): Near, Medium, Far

Výsledok po skončení EFS



Ďakujem za pozornosť