objective of the PPT

The title of the presentation

Last name first name student number
Supervisor: name

School of XXXXX
Beihang University

December 6, 2020

Outline

About the company

Name of the company Co.,Ltd.

1. well-kn supplof on-e rapiection solutions;
2. a complete R&D, produfter-sales see system;
3. ser the pubafety, food saand ml safety industries.

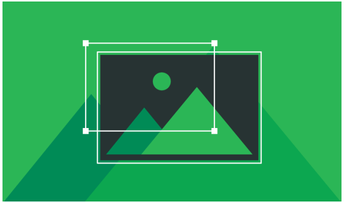

Fig. 1. Holeld exsive deter.

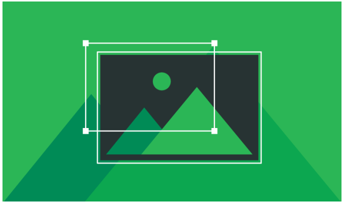

Fig. 2. Moile expive dettor.

Content of the intership

Norm (mathematics) From Wikipedia, the free encyclopedia

1. In mathematics, a norm is a function;

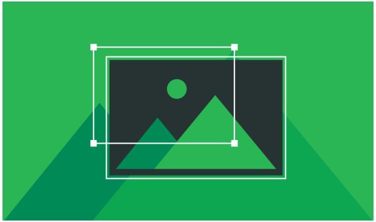

Fig. 3. UAV exsive detion.

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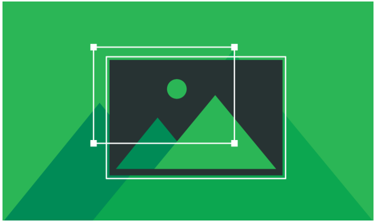

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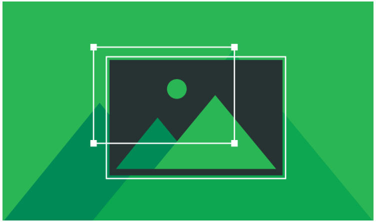

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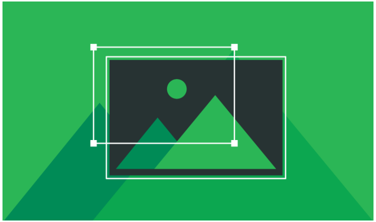


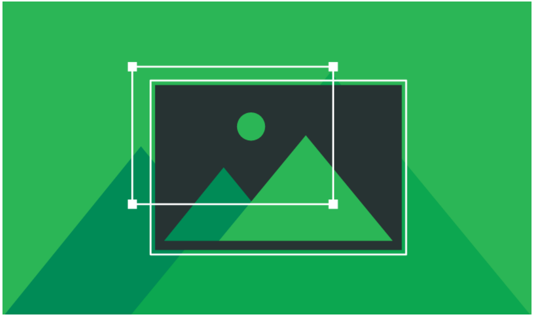
Fig. 3. UAV exsive detion.

Outline

QuadroAV modeling

Translational motion:

$$
\begin{cases}
m\ddot{X}^w = u_{c1}(\cos\phi\sin\theta\cos\psi) \\
m\ddot{Y}^w = u_{c1}(\sin\phi\cos\psi) \\
m\ddot{Z}^w = mg - u_{c1}\cos\theta
\end{cases} \tag{1}
$$



Rotational motion:

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\begin{cases}
I_{xx}\ddot{\phi} = u_{c2}l + \dot{\theta}\dot{\psi}(-I_{zz}) \\
I_{yy}\ddot{\theta} = u_{c3}l + \dot{\phi}\dot{\psi}(I_{zz}-) \\
I_{zz}\ddot{\psi} = u_{c4} + \dot{\theta}(I_{xx} - I_{yy})
\end{cases} \tag{2}
$$

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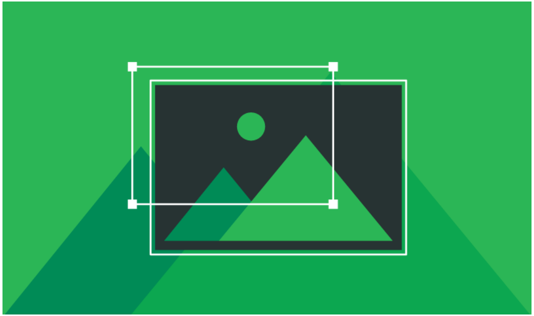

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$$\Downarrow$$

Reduced model:

$$\begin{aligned} \dot{p}_i(t) &= v_i(t) \\ \dot{v}_i(t) &= u_i(t) \end{aligned} \tag{3}$$

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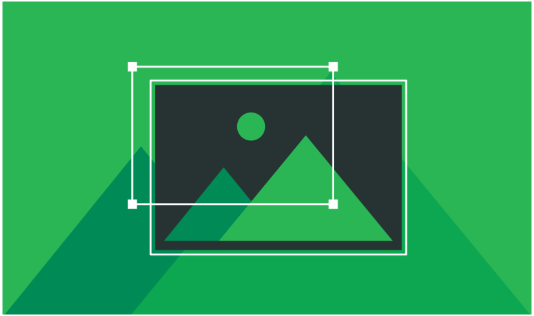

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$$\Longrightarrow$$

State space representaion:

$$\dot{x}_i(t) = Ax_i(t) + Bu_i(t), \qquad (4)$$

where $A = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0 \end{bmatrix}.$

Formation tracking

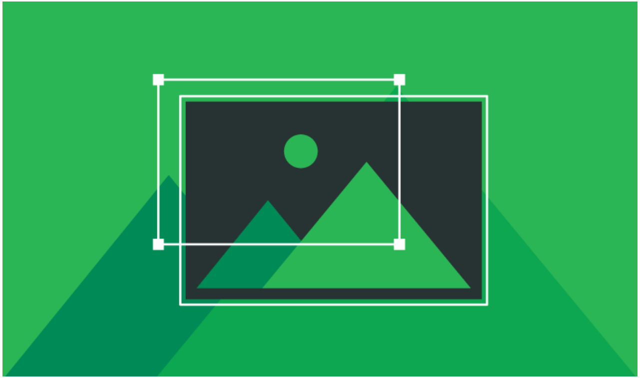


Fig. 4. Illustrof the ti forion tracking.

Outline

Sliding mode control

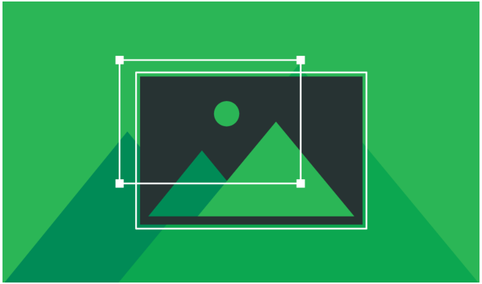
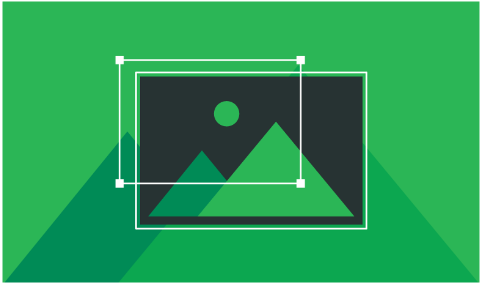


Fig. 5. Tratory of contnuous system.

Sliding mode control



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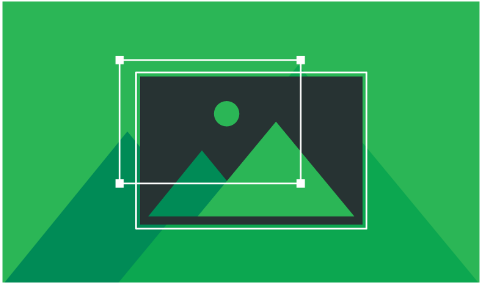


Fig. 6. Trajery of diete system.

Discrete-time SMC protocol

The following disibuted fortion procol is proposed,

$$
\begin{aligned}
u_i(k) =& (K\bar{B}(d_i + a_{i0}))^{-1}\Big(K\bar{B}\sum a_{ij}u_j(k) - \Big[K\bar{A}\big(x_i(k) - \sum_{j=1, j\neq i}^{N} a_{ij}x_j(k)\big) \\
& - a_{i0}K\bar{A}x_0(k) - a_{i0}K\bar{B}\tilde{u}_{i0}(k) + \varepsilon T\,\mathrm{sgn}(s_i(k)) \\
& - K\big((d_i + a_{i0})f_i(k+1) - \sum_{j=1, j\neq i}^{N} a_{ij}\big)\Big]\Big)
\end{aligned} \tag{5}
$$

where $\tilde{u}_{i0}(k) = \tilde{u}_1 - \mathrm{sgn}(s_i(k))$, $\tilde{u}_1 = (u_{min})/2$ and $\tilde{u}_2 = (u_{max} - u_{min})/2$.

Simulation results

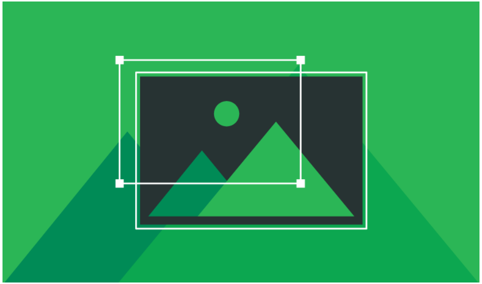


Fig. 7. Trajecto of seven UAin 40s in experiment 1.

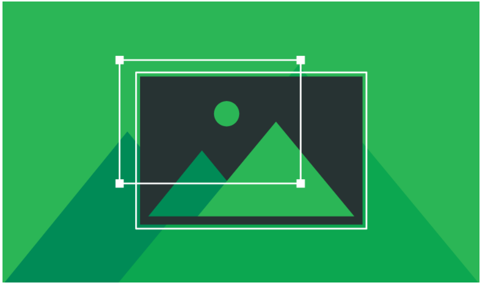


Fig. 8. PositioAVs at 40s in experiment 1.

Reinforcement learning

Markon Process (MDP)

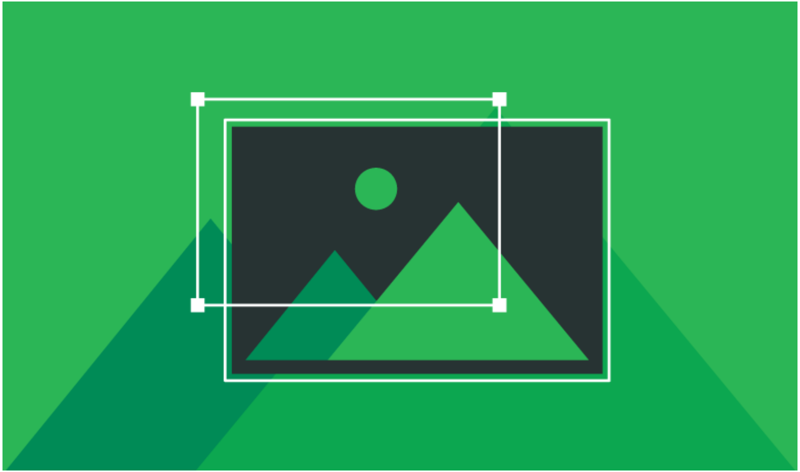


Fig. 9. The agection inion process.

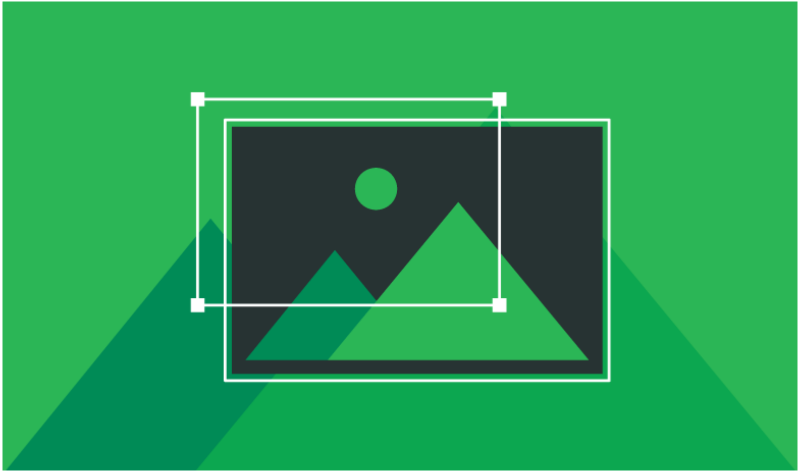
Reward function

Denote d the distance between UAV and target.

Table 1: Reward function definition oracking task.

	Condition	Reward (R)
1	$d < 0.05m$	+50
2	$d < 0.05m$	+50
3	$d < 0.05m$	+50
4	$d < 0.05m$	+50
5	no other reward	-1

Dyna-Q algorithm



Training results

- Stage 1: Fixedt tracking, with $(x, y) = (1.2m, -1.2m)$;
- Stage 2: Randracking, with $x, y \in [-3.6m, 3.6m]$;

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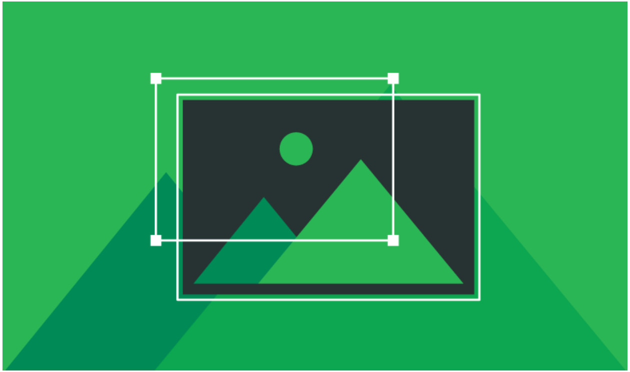

Fig. 10. Stage 1.

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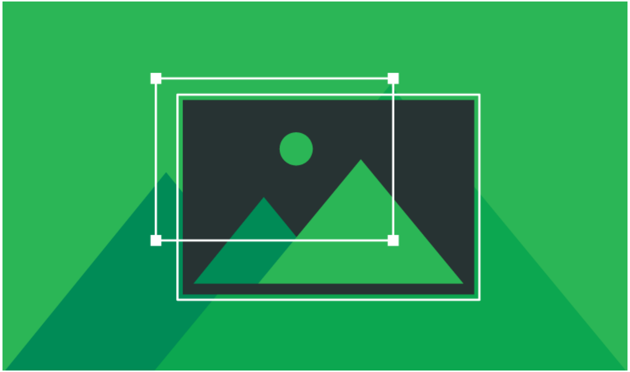

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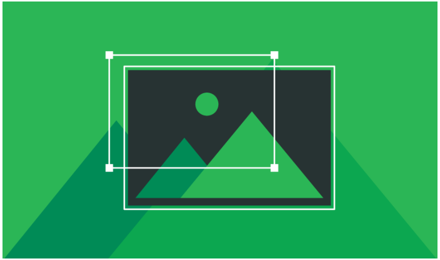

Fig. 11. Stage 2.

Formatng wi RL

- Leader UAV: circular mot $r = 10m$;
- Followers: tracking the learealize a square formation;

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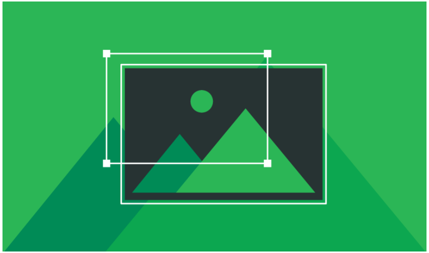

Fig. 12. Five UAVs before the formation.

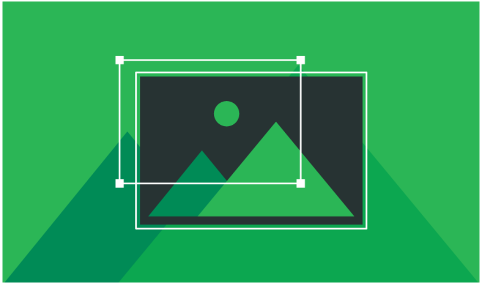

Fig. 13. Positions of five UAVs before the formation.

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- LeadeAV: ciular mot with $r = 10m$;
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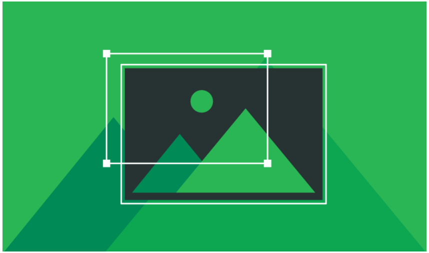


Fig. 14. Five UAVs after the formation.

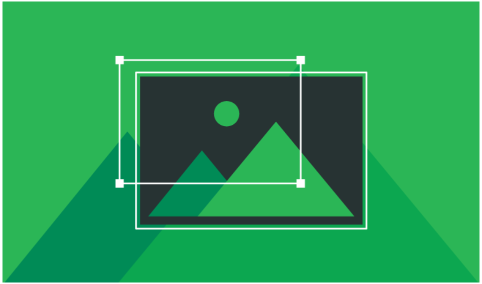
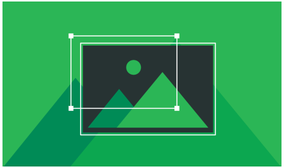


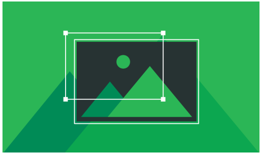
Fig. 15. Positions of five UAVs after the formation.

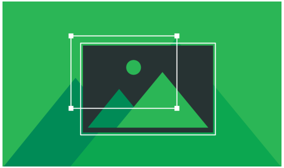
Outline

What I have donnterhip

- Utilization of timulator;
- Survey on the sle control theory;
- Survey on throl method with mulUAV system;
- RL algorithm trainingntation onplatform;

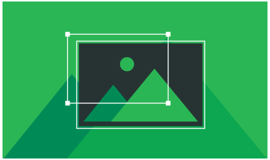






Self-evaluation

- What I have learned
  - Understanding of
  - Ability to solve complexe problems;
  - Quality of oral communication;
- To be improved
  - The ability to solve complems across fields and disciplines;
  - The ability to integrate and n special environments;
  - The ability to ask quality questions;



Thanks for your attention!
Q& A