

DeepEDR, a deep-learning based method to enhance biosensor dynamic range

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Abstract

Designing biosensors for precision regulation with a decent dynamic range remains challenging. Here, we report a new method for increasing biosensor dynamic range by using rationally-designed ribosomal binding sites (RBSs). DeepEDR is a deep-learning method for enhancing biosensor dynamic range, which uses semi-rationally designed RBS sequences as the data input and a convolutional neural network as the training model to predict biosensor dynamic range. We built the RBS-based DeepEDR model to fine-tune biosensor dynamic range. DeepEDR uses RBS big data according to a semi-rational design to provide a knowledge base for the precise adjustment of biosensors through deep learning, thus helping researchers better characterize biosensors by using RBS datasets. DeepEDR greatly simplifies the workload of the design–build–test–learn cycle in genetic component design and could aid in analysis of the dynamic ranges of other biosensors in bacteria.

Brief Biography

Dr. Yu Deng is the distinguished professor of Jiangsu Province in Jiangnan University. He got his Ph.D degree from Virginia Commonwealth University at 2011 and his postdoctoral training at Dartmouth College from 2011 to 2013. He was then an assistant professor in Kansas State University. He has published more than 30 research papers and owns 20 patents. His research interests include metabolic engineering, synthetic biology and systems biology. His research has been supported by NSFC, Jiangsu Province and Jiangnan University.

Brief CV

Yu Deng, Ph.D.

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Education:

2007.8-2011.5: Ph.D of Chemical and Life Science Engineering, Virginia Commonwealth University. Advisor: Dr. Stephen Fong

2005.9-2007.6: MS, Jiangnan University;

2001.9-2005.6: BS, Jiangnan University 2015.1- present: Distinguished Professor of Jiangsu Province, School of Biotechnology and National Engineering Lab for cereal fermentation technology;

2013.8-2014.12: Assistant Professor, Department of Biological and Agricultural Engineering at Kansas State University;

2011.5- 2013.6: Postdoctoral Research Associate, Thayer School of Engineering, Dartmouth College.

Research Interests:

1. Synthetic biology
2. Metabolic Engineering
3. Biochemical Engineering

Selected publications

1. Liying Ruan; Lu Li; Dian Zou; Cong Jiang; Zhiyou Wen; Shouwen Chen; **Yu Deng***; Xuetuan Wei*, Metabolic engineering of *Bacillus amyloliquefaciens* for enhanced production of S-adenosylmethionine by coupling of an engineered S-adenosylmethionine pathway and the tricarboxylic acid cycle, *Biotechnology for Biofuels*, 2019, 12:211
2. J Yang, Y Lu, Y Zhao, Z Bai, Z Ma, **Y Deng***, Site-directed mutation to improve the enzymatic activity of 5-carboxy-2-pentenoyl-CoA reductase for enhancing adipic acid biosynthesis, *Enzyme and Microbial Technology*, 2019, 125, 6-12.
3. Mei Zhao, Guohui Li, **Yu Deng***, Engineering *Escherichia coli* for glutarate production as the C5 platform backbone, *Applied and Environmental Microbiology*, 2018, 84:e00814-18.
4. Mei Zhao, Dixuan Huang, Xiaojuan Zhang, Mattheos A.G. Koffas, Jingwen Zhou and **Yu Deng***. Metabolic engineering of *Escherichia coli* for producing adipic acid through the reverse adipate-degradation pathway, *Metabolic Engineering*, 2018, 47:254-262.
5. **Yu Deng***, Ning Ma, Kangjia Zhu, Xuetuan Wei*, Yunying Zhao, Balancing the carbon flux distributions between the TCA cycle and glyoxylate shunt to produce glycolate at high yield and titer in *Escherichia coli*, *Metabolic Engineering*, 2018, 46: 28-34.