

# Интеграция Gunrock в QuickGraph

Чебыкин Александр  
371 группа, Мат-Мех СПбГУ

# Введение

- Gunrock - библиотека примитивов для программирования обработки графов на GPU
- QuickGraph - библиотека для удобной работы с графами на C#

# Механизмы интеграции

- Gunrock имеет интерфейс на C
- DllImport - вызов из C# методов скомпилированной библиотеки на C

# Код

- Отдельный проект в QuickGraph
- Заголовки методов вида
  - `public static Dictionary<int, int> RunBreadthFirstSearch<TEdge, TGraph>`  
    `(TGraph inputGraph)`  
    `where TEdge : IEdge<int>`  
    `where TGraph : IVertexListGraph<int, TEdge>`
- Реализовано считывание графов из файлов формата MarketMatrix

# Тестирование

- Железо
  - i5 3570k (3.6 GHz)
  - Gtx 1070 ASUS DUAL
- Алгоритмы: BFS, CC, SSSP
- Время среднее по 10 запускам
- Графы

Название	Описание	Вершины	Рёбра
chesapeake	DIMACS Implementation Challenges	39	340
Email-Enron	emails of senior management of Enron	36693	367662
roadNet-CA	California roads	1971281	5533214
delaunay_n21	Delaunay triangulations of random points in the plane	2097152	12582816
cit-Patents	Patent citation network	3774768	33037894

# BFS

	QuickGraph (mc)	Gunrock (mc)
chesapeake	0.5	17.5
Email-Enron	40.7	12.4
roadNet-CA	950.0	224.1
delaunay_n21	1500.2	235.6
cit-Patents	8298.5	1681.3

# CC

	QuickGraph (mc)	Gunrock (mc)
chesapeake	0.5	7.2
Email-Enron	70.4	13.1
roadNet-CA	1438.3	124.7
delaunay_n21	2038.5	166.7
cit-Patents	13188.2	462.5

# SSSP

	QuickGraph (mc)	Gunrock (mc)
chesapeake	0.8	6.1
Email-Enron	142	15.7
roadNet-CA	5315.3	376.3
delaunay_n21	6574.2	511.7
cit-Patents	29543.8	2348.0



# Дополнительная информация о графах

chesapeake.mtx

Degree Histogram (39 vertices, 340 edges):

Degree 0: 0 (0.00%)

Degree  $2^0$ : 0 (0.00%)

Degree  $2^1$ : 1 (2.56%)

Degree  $2^2$ : 22 (56.41%)

Degree  $2^3$ : 13 (33.33%)

Degree  $2^4$ : 2 (5.13%)

Degree  $2^5$ : 1 (2.56%)

Email-Enron.txt

Degree Histogram (36693 vertices, 367662 edges):

Degree 0: 1 (0.00%)

Degree  $2^0$ : 11211 (30.55%)

Degree  $2^1$ : 8967 (24.44%)

Degree  $2^2$ : 8661 (23.60%)

Degree  $2^3$ : 3742 (10.20%)

Degree  $2^4$ : 1957 (5.33%)

Degree  $2^5$ : 1156 (3.15%)

Degree  $2^6$ : 618 (1.68%)

Degree  $2^7$ : 256 (0.70%)

Degree  $2^8$ : 93 (0.25%)

Degree  $2^9$ : 22 (0.06%)

Degree  $2^{10}$ : 9 (0.02%)

roadNet-CA.mtx

Degree Histogram (1971281 vertices, 5533214 edges):

Degree 0: 6075 (0.31%)

Degree 2^0: 321027 (16.29%)

Degree 2^1: 1176030 (59.66%)

Degree 2^2: 468115 (23.75%)

Degree 2^3: 34 (0.00%)

delaunay\_n21.mtx

Degree Histogram (2097152 vertices, 12582816 edges):

Degree 0: 0 (0.00%)

Degree  $2^0$ : 0 (0.00%)

Degree  $2^1$ : 23718 (1.13%)

Degree  $2^2$ : 1803287 (85.99%)

Degree  $2^3$ : 270102 (12.88%)

Degree  $2^4$ : 45 (0.00%)

cit-Patents.mtx"

Degree Histogram (3774768 vertices, 33037894 edges):

Degree 0: 0 (0.00%)

Degree  $2^0$ : 667336 (17.68%)

Degree  $2^1$ : 683661 (18.11%)

Degree  $2^2$ : 861431 (22.82%)

Degree  $2^3$ : 968664 (25.66%)

Degree  $2^4$ : 480472 (12.73%)

Degree  $2^5$ : 98233 (2.60%)

Degree  $2^6$ : 13292 (0.35%)

Degree  $2^7$ : 1507 (0.04%)

Degree  $2^8$ : 144 (0.00%)

Degree  $2^9$ : 28 (0.00%)