Интеграция Gunrock в QuickGraph

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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>(TG
  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 (мс)	Gunrock (мс)
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 (мс)	Gunrock (мс)
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 (мс)	Gunrock (мс)
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%)